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DEFICIENCIES IN READING ABILITY

THEIR DIAGNOSIS AND REMEDIES

BY

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TO

MY FATHER AND MOTHER

WHOSE BELIEF IN EDUCATION
HAS MADE THIS VOLUME POSSIBLE

PREFACE

This volume has been prepared for use in special methods courses and in reading circle work. With these ends in view the author has made the subject matter as simple as seemed consistent with the nature of the problems treated. The intention has been to consider only material which is recognized as scientific and to discuss only those theories which are supported by facts.

The chief problem has been to present the subject matter so that it will aid the work of the teacher. The usual effort in this direction shows itself in contributions to general methods. The plan of procedure at this time involves individual methods. The attempt is made to give teachers a concrete and practical plan by means of which they can develop scientific methods to meet individual cases.

This book is the result of twelve years' interest in the problem. As a superintendent of schools at Spencer, Indiana, I had my attention directed to the problems of reading through the enthusiastic work of two primary teachers, Miss Jesse Mead and Miss Bertha Maegerlein. My first scientific contact with the problem was in a course given at the University of Chicago by Professor W. F. Dearborn. Later, through a grant from the General Education Board, I had the opportunity of doing a year's research work in the same University under the guidance of the Director of the School of Education, Dr. C. H. Judd. I owe much also to the Department of Education at the University of Texas. The interest of this department in work of this type has shown itself in the equipment of a laboratory in which I have been able to do considerable work on some of the problems discussed.

The reading teachers of the public schools of Austin, under the general direction of their Superintendent, A. N. McCallum, have coöperated heartily in testing out in a practical way some of the plans suggested for diagnosis and remedy.

I am also very much indebted to those investigators whose work has been quoted and to those authors who have allowed me to use their tests in the plan suggested for diagnosis.

Finally, I owe much to my colleague, Dr. B. F. Pittenger, and to Principal S. M. Lloyd of Dallas, for very careful and painstaking aid in putting the manuscript into final form.

C. T. G.

AUSTIN, TEXAS,
May 1, 1922

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DEFICIENCIES IN READING ABILITY: THEIR DIAGNOSIS AND REMEDIES

CHAPTER I

INTRODUCTORY

Reading is often said to be the most important subject in the elementary school curriculum. The high rank which this study holds is accorded it for various reasons. Chief among these is the fact that it makes possible a method of learning by which the pupil may teach himself. Methods of learning which do not involve reading may be considered as depending upon observation, oral instruction, participation, and other well-known processes. The young savage learns to construct his bow either by watching his fellows make theirs or by being told how such a thing is done. Under certain circumstances, such methods of learning have distinct advantages; and in many instances desirable results may be attained by them. In other cases, however, modern civilization has found that reading is a highly efficient method of learning, with distinct advantages. As a result, there are many occasions when this form of learning either supplements other methods or entirely replaces them.

Learning based upon reading involves the interpretation of the printed page. This is fundamentally different from a method based upon observation or word of mouth. The interpretation required by reading is an indirect process, while interpretation as involved in those methods of learning considered above is much more direct in its procedure. In other words, the reading act requires the interpretation of printed symbols which may be thought of as an indirect contact with the ideas set down on the printed page. This interpretation is distinct from the actual experience of the one who records the symbols and requires certain higher forms of mental activity not involved in the direct methods.

The difference between the direct and indirect method of learning is well illustrated in the case of the illiterate individual. Such a person has not acquired the indirect method of dealing with the experiences of his race. In many cases, he has been able to learn much by the direct methods; but lacking ability in the indirect methods, he cannot enjoy the benefits derived from contact with science, literature, and philosophy, and is even unable to keep up with current events of his own day. The illiterate himself is not the only loser. Since contact with these various types of material is essential to good citizenship, the welfare of society demands that every citizen be able to make use of the indirect methods of interpretation. This demand on the part of society has become so strong that the term " illiterate " is regarded as a mark of reproach.

Reading is also important in the school because it cannot be learned without teaching. One may learn certain things by watching others, but one can never learn to read in this way. The printed characters which must be interpreted in the reading process are highly symbolical and conventional. They do not bear any direct relation to the meaning involved and do not come within the range of ordinary experience. It is also true that the experiences of the reader are not apparent to an observer of the reading process. In other words, the vital activity of reading is a thing which must be explained. This is well illustrated by the amazement of the savages who watched one of our great explorers read a book. These unsophisticated people saw him reading hour after hour and could not understand why he could be so much interested in a dead and inert thing such as the book appeared to be. The only way in which this mysterious process could have been revealed to them would have been by instruction. Such instruction would necessarily have called attention to the nature of the symbols and to their meaning.

Not only in the case of the savage is instruction necessary, but also in the case of any one who is ignorant of the reading process. Such instruction is not necessarily technical. It may be received by the novice from one who is untutored and unlearned. Indeed, such instruction may be given without a text-book and without a knowledge of methods; yet the value of reading is so great as to demand that instruction in it be systematic and organized in order that the reading habits of the child may be placed upon a thoroughly efficient basis.

The importance of the reading act is also emphasized by the fact that little or no progress can be made in any school work until reading is mastered. Because of the emphasis placed upon reading in the American schools, they are often spoken of as reading schools. This is true not only for the reason that the American pupil is expected to read a great deal, but also because the early instruction of the pupil centers about reading. Moreover, teachers of the various subjects often report that pupils fail because they cannot read. These points serve to emphasize, again, the fact that instruction in reading, in the American schools especially, should be highly efficient.

The preceding paragraphs have set forth the importance of reading as it relates to education, and yet it must be remembered that reading in itself is not educative. In regard to this point, Parker (11)[1] says:

> Reading in itself has no educative value; it does not give rise to a succession of educative acts any more than does seeing, hearing, or touching. The value of reading in education depends entirely upon the educative subject presented, and upon the intensity of the conscious acts. — The educative value of reading, then, depends (1) upon what is read, (2) upon how it is read.

That reading is considered of first importance among school subjects is further shown by the amount of research which has been carried on for the purpose of understanding more clearly the reading process and perfecting the methods by which it is taught. These investigations have been made from different points of view. The first type of procedure used in attacking the problems of reading may be designated as the empirical method. This plan has been used by teachers of reading. The aim has been to find methods which would give children the power to read with a minimum of effort, and so save the time of both pupil and teacher. In many instances, these methods have centered about certain school systems or certain teachers, and information concerning these methods has been available for the most part by means of visitation or by conferring with those who have seen such methods in use.

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[1] Numbers in parentheses refer to the bibliography at the end of the chapter. Other bibliographies will be found at the close of each lettered division of the book.

The development of these methods is often accomplished by a progressive, well-trained teacher. She begins the use of a certain method of teaching reading and becomes expert in it. After using it for a time, she makes changes in it. She comes to appreciate its weaknesses and its strong points. She avails herself of suggestions from her supervisor and superintendent, and after a time, it is rumored that there is a teacher in the —— school system who is having remarkable success with reading. She proceeds further by printing supplementary exercises, and finally, she has sufficient material for a text or texts in reading. Often these books are printed with a view of setting forth a definite method of teaching reading.

Certain objections which are sometimes made to the empirical method of attacking the problems of reading may be considered. A new method is often criticized because the contribution which it makes is not apparent. In such instances it is probable that the new method is an adaptation of an older method to the personality of the one who has originated it, rather than a method which contains fundamental elements that are new.

Another objection sometimes made to the empirical procedure is that many methods of teaching reading are developed without a careful recording of results. This makes comparisons with other methods impossible. Such a criticism grows out of the fact that painstaking reports and records are considered essential to all scientific work.

Still another criticism is that methods of instruction in reading are many times developed without a careful consideration of the principles of psychology, sociology, and other factors which should serve as a basis for all reading work. Whatever the merit of these various criticisms, no one will deny that this procedure has made valuable contributions to the field of methods; and, without doubt, the teaching of reading has been very much advanced by the efforts of those who have worked from this point of view.

A second method of attacking the problems of reading has been used by psychologists. In fact, psychologists have employed two distinct methods, or have worked from two different points of view. One of these may be spoken of as the rationalistic point of view. In dealing with reading from this standpoint, an author lays down certain principles and, with them as a basis, attempts to evolve laws for procedure in reading. Dewey's (4) article on "The Primary Education Fetich" is a good example of this. In this article he argues the question as to when reading should first be taught. In order to solve the problem, he sets forth certain fundamentals of psychology and sociology, and argues from these principles that primary reading should have a place later in the curriculum than that which is usually accorded it.

The chief difficulty which attaches to the rationalistic method of attack lies in the fact that many of the arguments produced are likely to be from the standpoint of the adult rather than from that of the child. To obviate this danger, the principles with which the reasoning starts need to be scrutinized very carefully; and even if they have been well selected, care must be exercised to avoid going astray in the conclusions drawn from them. This method has been criticized by teachers in service as producing results which are theoretical, but no one will deny that it has given rise to many important problems in reading, and has helped much in their solution.

The second method of the psychologists may be spoken of as the objective method. In this, the psychologist stresses the fact that accompanying the mental operations of reading there are certain objective phases which throw light upon the nature of the reading process. These objective phases of reading are illustrated in such motor activities as breathing and vocal reactions. That these play a part in oral reading is easily observed; and study shows that other motor activities, as eye-movements and inner speech, have much to do with silent reading.

The objective method differs from the rationalistic method in that it requires the collection of data under controlled conditions. Conclusions are reached by interpreting such data rather than by reasoning from general principles, as is done in the rationalistic procedure. One shortcoming of the objective method may be noted. This is that the more subjective and subtle phases of reading are very difficult to investigate in this way. This may be true at present; yet as methods become more and more refined, such an objection should be eliminated. The results obtained by the objective method have also been considered as too theoretical by teachers in service. However, it is probable that more contributions have been made to the psychology of reading by this method than by any other.

The problems which have been attacked by the objective method are five in number, as follows: (1) The laws of visual perception as they relate to reading; (2) the motor processes involved in the act of reading; (3) certain abnormal phases of reading; (4) the measurement of reading ability by means of tests; and (5) certain higher mental activities connected with reading.

Each one of these problems is exceedingly complex and will be treated in later chapters. Much of this material has been worked out in laboratories by men not interested in the educational aspects of their problems and who were not especially concerned in having their results read by those interested in the educational phases of their work. Moreover, scientific material is often set down in a style which makes it difficult reading for those not trained in the methods of the scientist. As a result, many teachers have ignored this entire body of material.

There is, then, an extensive literature upon the psychology and pedagogy of reading. This material may be divided into two distinct parts. One of these is the literature of empirical methods. This is usually thought of by teachers of reading as being practical in the suggestions which it makes. The second division may be spoken of as scientific material. This has often been considered by teachers of reading as impractical in its nature. As a result, these two fields have been permanently separated in the minds of many teachers.

It is interesting to note that certain authors who attempt to write practical books for teachers of reading leave out almost all the scientific material upon reading. On the other hand, many scientific books upon reading leave the teacher to make her own applications. In either case, applications are unlikely to be made. On account of its practical nature, teachers of reading have the field of methods well in hand; but because of its reputation for being theoretical, the body of scientific literature has not been so helpful to teachers as it is possible for it to be.

With a view of unifying in the mind of the teacher the two bodies of material mentioned above, the author of the present treatise will deal with the various problems of reading methods from the standpoint of scientific diagnosis. The meaning of the term "diagnosis" at this time is limited to that procedure which enables the teacher to determine the difficulties of those pupils who are below the standards for their grade and to establish variations in methods of instruction which will meet the needs of these pupils.

The diagnosis of individual difficulties is not new. Teacher use it in much of their work. Their plan may not be systematic but it includes most of the essentials of the process. Not long ago the writer heard a teacher in a reading recitation say to one pupil, "Your difficulty consists in reading too slowly;" and to another she said, "Your difficulty is mispronouncing small words;" and to a third she said, "Your difficulty is repeating the first word which comes after a period." Such a method is to be commended; and it is in the hope that it may become more common and more systematic that this treatise is written.

The fundamental purpose of the teacher mentioned above was to make her instruction for each pupil more effective. A conference with her showed that she recognized two types of instruction. These may be designated as group teaching and individual teaching. In the first type of instruction she used the same methods and devices for all pupils, while in the second type she was attempting to use those methods and devices which would meet the needs of individual pupils. She stated, further, that the two types of instruction which she employed differed more in quantity than in quality, because she did not have means at hand with which to determine in any definite way the difficulties of the individual pupil.

Further general illustrations of the two kinds of instruction may be taken from the teaching of reading. For instance, the word and sentence methods have been developed and perfected in a marked degree for group instruction; but few variations of these methods have been made for either backward or bright pupils. If such children are given the benefit of individual instruction, they are allowed, in most cases, to read more extensively; but the methods are varied little, if any, to meet the special needs of individual pupils. The difficulty lies in the fact that no thoroughgoing individual instruction in reading can be given until a careful and systematic study of the individual pupil's reading ability has been made. Such a diagnosis reveals the strong and weak points in the ability of the child, and special instruction can then be made effective because the needs of the child are understood.

Individual diagnosis, then, leads to the individualizing of methods. It becomes helpful at the point where general methods begin to prove ineffective. It affords individual instruction based upon the needs of the individual. These needs are determined by a careful study of the individual. Diagnosis grows out of and is based upon the scientific studies of the reading process. In this way diagnosis utilizes the scientific material relating to reading as a basis for individual methods of instruction and thus serves to unify in the mind of the teacher the two divisions of the literature upon the problems of reading.

Two methods for accomplishing this individual diagnosis are available. These are by means of educational tests and laboratory experiments. The value of tests for accomplishing this purpose is just beginning to be realized by all those interested in the problem of diagnosis. Certain tests which have been devised recently are termed diagnostic tests, and others are having their diagnostic values pointed out by those who use them. Some authors of tests attack the problem of diagnosis directly, whereas others are content to point out the value of diagnosis and to make very general suggestions as to methods of procedure.

Still less progress has been made in using the results of the laboratory as a basis for diagnosis. This is due in part to the fact that until recently no definite relations between the results produced by the laboratory and reading ability had been established, and in part to the fact that such experiments as they are usually conducted are very complicated. However, the value of results obtained by this method for interpreting the data procured by tests is so great that no thoroughgoing diagnosis can be attempted without them. For this reason it is necessary that special forms of certain laboratory experiments which relate to reading be introduced into diagnostic procedure.

The plan set forth in the pages to follow involves both reading tests and modified forms of laboratory experiments.

The meaning of the term "diagnosis" is further limited in this text, in that such procedure is attempted only for certain types of pupils. The methods set forth here are intended to meet the needs of only those children who have deficiencies in reading ability which are remediable. Therefore, the defects of abnormal, subnormal, or mentally defective children will not be considered, because most, if not all, of those in these classes lack reading ability to such a degree that remedial measures would avail little. For the same reason the very backward pupil, the dullard or the child who is very poor in all his work, is not considered. Other children are truly defective so far as reading ability is concerned, but they would not be ranked as mentally defective by any standard intelligence tests. In some instances these deficiencies are remediable, while in others thev are not. It is doubtful if defects of this type can be dealt with successfully by teachers, and for this reason attention will be given to them only as they shed light upon other forms of reading difficulties.

Still other children have deficiencies in reading ability to such a slight degree that the term "defective" is hardly applicable to their cases. They have difficulty in learning to read, but their difficulty is not sufficiently great to be thought of as the result of a defect. In very few instances will remedial work fail for those who fall in this group. Pupils of this type demand much of the teacher's time and energy. They are the ones for whom the general methods of instruction do not suffice and for whom individual work must be provided. Readers who fall in this group are of greater interest than any others in the discussions to follow.

The last class of children to be mentioned in this connection are those whose only deficiency is that they do not measure up to standards. Such pupils may be the victims of poor instruction, or they may be unfortunate in having had little or no instruction. Remedial work for those in this group is not difficult.

In conclusion, the children who are given chief consideration in the following pages are those whose reading ability is not up to standard and whose deviation from the standards is the result of a deficiency which is remediable.

THE LITERATURE UPON INDIVIDUAL DIAGNOSIS

One of the first attempts at individual diagnosis was made by Uhl (13). This investigator made a diagnosis of the reading ability of a group of pupils in the Oshkosh Normal Training School. All pupils from the third to the eighth grades, inclusive, were first given the Kelly silent reading tests. The next day the Gray oral reading scale was given to each of the same group of pupils. The following defects were noted: (1) Too great care; (2) carelessness; (3) mispronunciation of small words; (4) carrying over the directions of one test to another; (5) reading word by word; (6) reading very loudly; and (7) repeating the first word of every sentence. In addition to the analysis just noted, a record of certain other points which came under the observation of the experimenter was made. This record included lack of intelligent interpretation, hesitancy, and gross bodily movements.

Another author who attacks the same problem is Zirbes (14). By using tests and observations, this author finds that difficulties in reading result from (1) lack of proper phrasing; (2) lack of proper motor habits for the eyes; (3) lack of ability to get meaning from a passage as a whole; (4) lack of ability to get a particular idea; (5) lack of ability to differentiate words; (6) errors in oral reading, as omissions, repetitions, etc.; (7) lack of proper breath control; (8) lack of proper articulation; (9) and lack of voice control.

Another element which entered into the diagnosis made by Zirbes was the rate of silent reading. The division of her class into groups upon the basis of this element was as follows: "A" readers were those whose rate was more than thirteen lines per minute; "B" readers were those whose rate was more than nine lines per minute but less than thirteen; "C" readers had a rate between six and nine lines per minute; and those whose rate was less than six lines per minute were spoken of as "D" readers. Each of the defects mentioned above and each of these groups had special remedial measures applied. A discussion of these measures will be given in a later chapter.

Brown (2) touches upon the problem of diagnosis in these words:

> Pupil number one is deficient in the rate at which he can read, he gets a relatively large proportion of the context at his present rate of reading, but he reads so little in the unit of time, that his efficiency is low. [Further he says:] Pupil number five has a difficulty which is easy to diagnose. In the first place, his rate of reading is not sufficiently rapid, but his quantity of reproduction is high. His mark for quality, on the other hand, falls to zero. In other words, he gets a good many ideas in the rough, but gets nothing accurately. What he gets is a mere smattering of the idea. His low mark for comprehension, together with his low rate of reading, gives him a low efficiency.

Judd (8) has emphasized four difficulties in reading. These are: lack of ability to analyze words, overcare in reading, rapid reading which neglects details, and careless reading.

Monroe (10), in a chapter on "Correcting Defects in Reading," has summarized and discussed various methods of diagnosis.

Starch (12) has diagnosed a single case of slow assimilation. His methods involved both oral and silent reading tests as well as tests of perception, of the range of distinct vision, of vision and of muscular control.

Lloyd and Gray (9) have used the diagnosis of individual difficulties as a method for improving the reading in an entire school system. Four different types of data were used as a basis for the diagnosis. These were results from Monroe's silent reading test, from Gray's oral reading test, from short exposure experiments, and from the observation of eye movements. The last two methods were not used in all cases. With such data before them these authors diagnosed the difficulties of those children who, according to the Monroe test, fell below the class median. A class sheet which showed the diagnosis of each pupil, along with the proper remedial measures, was furnished each teacher. The teachers used the suggestions from this class sheet as a basis for their procedure in improving the reading ability of their pupils.

Courtis (3) has discussed the problem of diagnosis in this manner:

> The child whose rate falls below the standard for his class is in need of special assistance. The causes of faulty reading are many, not one, and the remedy to be applied differs from individual to individual. Training in eye-movements, in ability to grasp words, and in reaction time are among the types of training which might be used by the progressive teacher.

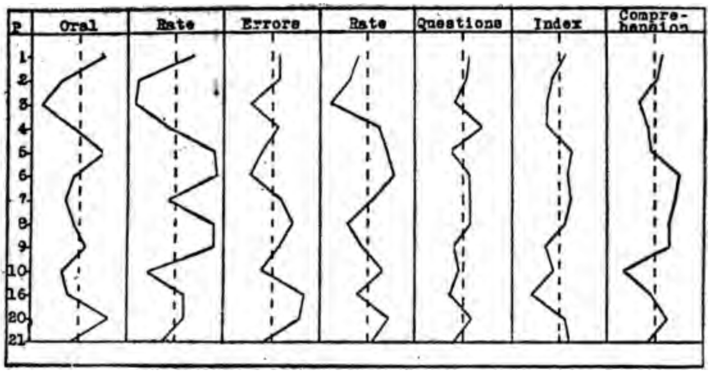
In addition to the above points, the same author has suggested a plan for making a diagnosis as shown in Diagram I. The method is based upon his reading tests and the procedure is set forth in a definite and concrete way.

DIAGRAM I — COURTIS' DIAGNOSTIC CHART

SCORES				INTERPRETATION
Type	*Rate of Reading*	*Rate of Answering Questions*	*Index of Comprehension*	*Probable Meaning*
1	High	High	High	Marked ability.
2	High	High	Low	Needs training in accuracy.
3	High	Low	High	Defect in mechanical skill offset by intelligent rereading until meaning is comprehended.
4	High	Low	Low	Poor training or poor ability.
5	Low	High	High	Cautious, careful reading on first trial. Such children usually make much higher scores on second trial.
6	Low	High	Low	Marked lack of intelligence.
7	Low	Low	High	Lack of native ability, but good training.
8	Low	Low	Low	Lack of native ability, or marked defects in training.

Gray (5) has prepared a diagnostic chart as shown in Diagram II. This chart gives data upon seven different phases of reading ability as indicated at the top of the diagram. Each digit at the left represents a pupil, and the broken vertical line represents the average score of the grade for the given phase of reading.

DIAGRAM II — GRAY'S DIAGNOSTIC CHART.



By following a horizontal line across the chart, it is possible to tell the accomplishment of any pupil in any phase of reading ability listed. If the horizontal line cuts the zigzag line to the left of the vertical broken line, the pupil is below standard; but if the zigzag line is cut to the right of the vertical line, the pupil is above standard. Viewed from this standpoint, pupil three is evidently very weak in all elements of reading listed, while pupil twenty appears very capable. Such a chart put in the hands of a teacher after the members of her class had been measured by a standardized test would be of great help in keeping before her the needs of the various pupils.

Gray (6) has also suggested a plan for carrying out diagnosis in an entire school system. In the same connection he gives the diagnosis of one case in which the five outstanding defects were as follows: (1) inappropriate motor habits in making the return sweep of the eye; (2) irregular progression of attention from left to right; (3) failure or inability to scrutinize words in sufficient detail to recognize significant parts; (4) inability to analyze new words; and (5) inability to recognize words in groups or thought units.

Anderson and Merton (1) have reported upon the diagnosis of six cases. The defects shown in these are as follows: (1) too great a knowledge of the mechanics of reading; (2) lack of familiarity with printed forms; (3) lack of phonetic knowledge; (4) lack of ability to phrase; (5) lack of background of meaning; (6) small span of recognition; (7) bad eye habits; (8) scanty visual vocabulary.

Judd (8) and Freeman (7) have reported upon cases of word blindness.

A survey of these defects shows that certain ones may be classified under each of the phases of reading ability already mentioned. A thorough understanding of such deficiencies requires a careful study of the scientific investigations which have been made of the reading process.

In conclusion, diagnosis involves four factors. These are: (1) analysis of the ability involved; (2) the measurement and estimation of this ability; (3) a careful recording of the results obtained from the process of measurement; (4) the interpretation of the results. Other processes which always follow closely upon diagnosis are training activities which are remedial in nature. In fact, without such suggestions, diagnosis loses its value. The only reason for making a careful diagnosis is that certain measures may be found for relieving conditions indicated by the diagnostic process.

Without doubt, the various authors whose work has been reviewed have emphasized most, if not all, of the essentials in diagnosis; yet no comprehensive method, with careful and detailed instructions for carrying out such procedure, has been produced. It is the purpose of the present volume to present such a plan in order that teachers may have at hand methods for studying individuals. Many teachers are especially interested in such problems, but they do not have opportunities to develop plans for making such work systematic. If they had at hand methods and means for carrying out such studies valuable contributions would doubtless soon be made to th methods of instruction in reading.

The treatment of this problem will be divided into three main parts. First, the analysis of the reading process as found in the various scientific studies of reading will be set forth Second, tests and experiments for determining various grade and levels of reading ability will be suggested. These will be accompanied by convenient methods for recording results and careful instructions for the interpretation of data Third i order that such diagnosis may have real value, remedial measure will be presented.

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PART I

THE ANALYSIS OF READING ABILITY

A. THE ANALYSIS OF READING ABILITY FROM THE STANDPOINT OF READING TESTS AND THEIR RESULTS

CHAPTER II

A CRITIQUE AND SURVEY OF READING TESTS

Many of the recent contributions to the psychology of reading have been made by means of standardized reading tests. It is the purpose of this chapter and the one which follows to study these tests and their results in order to determine, first, the points in this literature which make for a fundamental analysis of reading ability, and second, the diagnostic value of the tests.

The purpose of all reading tests is the measurement of reading ability. The full significance of this statement involves three problems. The first of these requires that reading ability be defined; the second demands that the nature of the methods of measurement be made clear; and the third is concerned with the requirements of tests as agencies of measurements. A treatment of these problems will serve as a basis for the discussion of the existing tests which, as was suggested above, is the fundamental problem of the chapter.

READING ABILITY

This term has two different meanings. It is often used in the sense of attainment. Reading ability as attainment is exhibited in rate of reading, in comprehension, and in other phases of the reading act. The various forms of attainment depend upon certain mental activities, such as reasoning, imagery, and perception. It is to these mental processes which are so intimately related to attainment that the term "reading ability" is often applied. In many cases reading ability will mean attainment; in other instances it will refer to those processes which are fundamental to attainment.

THE MEASUREMENT OF READING ABILITY

This problem has three different phases. They are: (1) the establishment of a unit, or units, of measure; (2) the application of this unit, or of these units, to the measurement of reading; (3) the interpretation of the results.

The first phase has given rise to a variety of units. This is due in part to the complexity of the reading activity, and in part to divergent opinions among investigators as to the unit which it is best to use. A definition for a unit of reading ability may be quoted from Brown (2), as follows:

> One unit of reading efficiency is a reading ability in which a rate of reading in words per second is combined with such a power of reproduction that the product of the numbers, the rate and the average of the numbers representing the percentages of quality and quantity is unity. A person who can read at the rate of five one hundredths words per second and whose quality of reproduction is three per cent and whose quantity of reproduction is one per cent has one unit of reading ability.

Such a definition helps to make clear the meaning of the term "reading unit," but this particular one has been put to little practical use.

The second phase is usually handled by the use of tests. Variety is again found in the types of test employed. This is probably due, not so much to divergent opinions concerning the nature of reading ability, as to the fact that different units of measurement require different methods of application.

The third phase is complex in its nature, for the interpretation of results is not always easy. The problem of measurement is of such a nature that large numbers of individuals must be included in the final results. For this reason elaborate statistical methods must be employed. The difficulties of interpreting material treated in this way are well understood.

In addition to the fundamental problems of measurement just treated, there are certain difficulties which are met in applying any method by which reading ability is to be measured. Such difficulties will be discussed briefly.

The first of these is one which is encountered in the measurement of all forms of mental activity. Mental ability cannot be measured in a direct manner, but must be attacked by indirect methods. An indirect method measures a performance in which the mental activity under consideration is exhibited. The results of such measurements are taken as an indication of the presence or absence of the mental activity under consideration, and as an estimate of its amount when present. This means that measures of performance in reading are used as measures of the mental activity known as reading ability. The difficulty with such a method is that there are many other things aside from reading ability which affect performance. It may be affected by the physical condition of the pupil, by the time of day, by the temperature of the room, and by many other factors. If proper precautions are taken, the effect of most of these elements may be reduced to a minimum. In view of this, performance in reading is usually accepted as a measure of reading ability. However, it is exceedingly important in interpreting the results of reading tests to have in mind that the immediate thing measured is performance, and that this is taken as an index of reading ability.

The second difficulty involved in the measurement of reading ability is due to the fact that the reading activity is not always objective. Whenever a response which lacks objectivity is to be dealt with, the application to it as any kind of unit is exceedingly difficult. This point is illustrated by those phases of reading which are emotional in nature. It is a well-known fact that, from the standpoint of measurement, mental activity of this kind has been the most difficult to deal with and that little progress has been made in such procedure. In some instances, however, certain conditions can be imposed upon these subjective phases of reading which enables them to be measured. The objection to this procedure is that the imposed conditions are foreign to the reading activity, and as a result they may alter the reading act. It is not difficult to see that results obtained in such a way may not be representative.

The third difficulty grows out of the fact that reading is an exceedingly complex process. For this reason, it is very difficult to devise a single test by means of which, alone, this highly complex process can be measured. If the reading ability of an individual pupil is to be investigated in its entirety, different tests, each of which measures a different phase of the reading activity, must be used. This point is illustrated by the fact that there are both oral and silent reading tests, and that several different methods have been used for measuring comprehension in silent reading.

In addition to these difficulties, Judd (15) suggests two others. The first of these has reference to the fact that it is impossible to get material for a test which makes the same appeal to every pupil, or which has the same interest for every reader. Such differences may affect the results of testing to a considerable degree. The second difficulty mentioned by Judd, refers to the various levels on which the reading act may proceed. It is well understood that reading may involve merely the calling of words, or it may require the interpretation of the most abstruse material. A few years ago the difficulties just enumerated seemed almost insurmountable; but much progress in dealing with them has been made.

REQUIREMENTS OF TESTS

In order that reading tests may be valid, there are certain general conditions which they must satisfy. These requirements are of interest at this point, because accurate analysis of the reading process will depend upon the accuracy of the results obtained by the tests used. Such criteria develop out of the knowledge which is at hand concerning reading ability and the experience which has been gained from the many different types of testing.

Mechanics of the Test. (1) The test should be printed on a good quality of paper and in a kind of type which is clear and easily read. (2) The form of the test should be such that it can be handled by a child without confusion or delay. (3) Matters are often simplified if the directions to the teacher and the form for compiling the results are printed on a sheet separate from the test.

Ease of Scoring. If the test is to be used by teachers who have but little time and little training for doing such work, the process of scoring must be simple. The plan involved should give a high degree of objectivity with a minimum of difficulty for the teacher.

The mathematical calculations must be simple and few in number. Few teachers have the time or patience to learn a complicated process of calculation, and no one cares to make a large number of calculations, even if they are simple.

Administering the Tests. Any test, to be successful, must be easy to administer. The directions to both the teacher and the pupil should be simple and easily understood. This does not mean that tests which are involved in their nature have no place, but it is far better for such work to be done by trained persons under conditions where pupils may take such a test singly or in small groups.

The Test Should Deal with an Essential Phase of Reading. All phases of reading which are dealt with by means of tests should be essential and fundamental to the work of the pupil. Any test which is used by teachers will have a tendency to cause them to emphasize in their work the particular type of reading which is employed in the measurement work. Hence, there is the danger that the emphasis in reading instruction may be misdirected by the tests used.

Dependence upon Memory. The response in much of reading is subjective. For testing purposes, it is necessary to make such responses objective. Such an objective response must come after the subjective response and hence depends upon memory. It has usually been considered that a test involving a large degree of memory on the part of the pupil is not so good as one in which memory appears only slightly. It is doubtless true that children differ very much in the amount of memory which they are able to enlist in their responses in reading. One view of the matter would consider it a phase of comprehension which should be carefully measured along with other elements in reading ability.

Amount of Material Read. Much of the reading done in the school involves large amounts of material and requires the determination of relations between the various parts of the matter read. The question arises as to how short the reading period as required by a test, may be and yet serve as a measure of reading ability. Starch (31) investigated this problem and found that a period as short as thirty seconds might be used.

Differences between Reading and Study. The school makes a careful distinction between these two types of work. Study usually involves several readings and more or less reflection on the part of the pupil. Reading is more superficial, and the element of reflection is not so pronounced. Brown (2) holds that reading and study are synonymous. It seems more consistent to think of reading as fundamental to study, and to think of study as being made up of several readings, or of reading plus something else.

What Does the Test Measure? The difficulty in all mental testing has been to devise tests which measure a particular mental activity without introducing other elements. Accurate limitations of tests becomes an important problem in reading. It is necessary to be sure that memory, ability to reproduce, and other forms of mental activity are not measured instead of reading ability. It may be true, also, that such abilities are tested in addition to reading ability. If such is the case, the problem of interpretation becomes difficult. On the other hand, it is possible that the correlation between these various abilities and reading ability is high, and as a result such factors may be neglected.

Refinement of Tests. The science of statistics has produced certain methods by means of which it is possible to refine tests and scales. Chief among these methods as they apply to reading is the one which allows a series of reading passages to be arranged in order of their difficulty with equal steps of difficulty between each two selections. Other methods have to do with the scoring of results and the establishment of standards. It is essential that any test make the most of these refined methods.

Dependence upon Language Ability. Children differ very much as to their ability to deal with new and difficult words, in the ease with which they become familiar with new problems in language, and in their ability to write fluently and accurately. In most tests of reading ability, the above factors are elements in the response, and as a result the individual endowed with such language ability does better in reading tests than others. For this reason, any test which limits the amount of language used in the response is usually considered superior to one which requires much language. However, the importance which attaches to the language response both in school and daily affairs raises a question as to whether the type of test which involves considerable language response should be neglected. Without doubt tests with other types of response are necessary, as well as those which involve language. From the standpoint of methods it is highly necessary that the teacher have in mind those children who can make only the simpler forms of response to their reading as well as those who can make the more complex responses.

Types of Material Used. It is possible to have as many different scales as there are different types of discourse. So far, most of the tests have employed narrative prose.

This problem may also be viewed from the standpoint of the types of material used by the school. Such material may be described roughly as connected material and topical material. Selections used in reading or literature illustrate the first type, and many historical or geographical text-books illustrate the second type. In the case of the latter material, the different topics may be somewhat disconnected, but so related that they group themselves about larger topics.

Both types of material have been used by those who have devised reading tests. One difference which exists between the topical material, as discussed above, and that used in certain tests should be noticed. The test material which has been used thus far presents topics which are entirely unrelated. This means that the reader has to adjust himself to an entirely new type of material each time a selection is begun. The difficulty of such conditions is that the mental set of the preceding selection may be carried over into each succeeding selection and thus there may be a source of confusion introduced into the reading of each passage.

If the connected form of material is used, one selection may be used by all or part of the school grades, or there may be different selections for each grade. In the first case, a comparison of individuals is made by the amount of material read rather than by the difficulty of the material. The assumption is made that since comprehension and rate vary from individual to individual or from grade to grade, these differences will appear in the amount of material read. Such a view seems to indicate that all comprehension is of the same type, and that experience and training allow it to proceed at a greater rate in the case of some pupils than is true of others. Another view would be that the higher levels of comprehension involve certain mental activities which are not found in the lower levels. A test which employs material of varying difficulty would have the advantage of testing different levels of comprehension rather than a single level. Burgess (3) has presented arguments to show that reading tests based upon variations in the difficulty of the passages employed are not practicable. The arguments point out that in such scales it is almost impossible to properly control the time. The fact that this element is not properly controlled allows the child to skip around in the test and also gives opportunity for him to put much more time on one passage than another. These conditions give, according to this author, conglomerate scores of difficulty, quality, and amount in unknown and varying proportions. The same author has shown also that scores based upon the amount done are the most practicable. This is due to the fact that such scales make possible a better control of the time, of the difficulty of the passages, and of the response, than any other type of test.

EXISTING TESTS

The next topic to be discussed is concerned with the tests which are being used. When this problem is approached, it is found that there is no general test for reading ability, but that a series of tests has been developed. Each of these is more or less specialized. The divisions to be mentioned at this point are those concerned with oral and silent reading.

ORAL READING TESTS

Consideration of the tests which are being used in this field shows that no author pretends to have a test which covers this phase of reading ability in its entirety. It is recognized that ability in oral reading is of such a nature that it can be analyzed into various factors. A tentative analysis reveals at least four different standpoints from which this type of reading may be viewed. These are as follows: (1) as to the effect upon the hearer, (2) as to its quality, (3) as to the rate at which it proceeds, and (4) as to the language ability involved.

The Effect upon the Hearer. This phase of oral reading is emphasized in certain kinds of acting, in elocution and in public speaking. The same type of reading is involved in the instruction of a class in which the teacher has a child read before the class a selection, which has not been previously heard by the children. The problem of the reader is to make the passage intelligible to the class and to bring out any emotional effects which may be contained therein. Such reading is to be measured largely from the standpoint of the effect produced upon the hearer. If an actor receives a large salary from his manager, this manager is very much interested in the effect produced by the actor on his audience. A large part of such an effect is produced by the actor's being able to *read* his lines well. It is also true that the audiences who go to hear this actor, do so, in a measure, because they expect certain reactions to be produced within themselves by the work of the actor. From the above discussion, it will be seen that any public reader is interested in the effect of his work upon his listeners; and if he succeeds well in his work, he does so because his listeners enjoy the responses which he is able to produce in them.

It is not too foreign to the topic at hand to emphasize that this phase of reading has received little attention in the schools. The child may read to the teacher or he may merely read the book, but it is very seldom that the audience receives any attention. Occasionally, one finds a teacher who has a child stand before the class and read a selection which the children have not heard before. After the reading is finished, criticisms follow which are based upon the understanding and feelings produced by the reading. Reading viewed from this standpoint is almost entirely subjective in its nature. For this reason, no attempt has been made to measure the effects produced by such reading.

Quality of Oral Reading. If the work of an actor is considered again, it is clear that the performance of such a person may be viewed by another from the standpoint of the technique and methods used to get results in the reading of the lines. Such technique involves poise, pitch of voice, emphasis, and many other elements. This phase of reading is emphasized very much by the instructor in public speaking, oratory, and other forms of public discourse, but only slightly by teachers of oral reading in the elementary schools. In general, it is true that the reader with the best technique gets the best results.

In evaluating this phase of oral reading, the writer (8) has considered the following qualities: poise, pitch, articulation, pronunciation, emphasis, force, and interpretation. The plan used is tentative only. It could be refined considerably by determining the relative values of the various qualities, and by making the scores less subjective on the part of the examiner.

Rate of Oral Reading. The rate of oral reading is peculiar in that it is very much limited by the physiological phases of vocalization, and by the fact that the perception of language through the ear is, relatively speaking, a slow process. For these reasons, oral reading can proceed only at a speed which is relatively slow. If, however, the reader could develop a very high vocal rate, such a rate would not be permitted on account of the difficulty of interpretation on the part of the hearer. This means that there is a certain limit beyond which the rate of oral reading must not pass, if the quality of the reading is to be considered good. Such a limit is probably an individual matter, the exact determination of which could be established only by careful experimental work. For the purpose of testing, however, some general rules in regard to the matter seem necessary.

If this view is correct, it is true that in scoring oral reading a positive score should be given for rate up to this limit and a negative score if the rate surpasses this limit. In the tests which have been used thus far, a positive score has been given for all rates. Such a plan allows the subject to increase his rate deliberately beyond the point where good reading is possible, provided the mechanical manipulation of the language is correct. If only the positive score is given, it is possible for the best scores to be made by persons who are, in reality, reading very poorly.

Another problem in connection with rate is concerned with the language unit in which this phase of reading should be expressed. Both Gray (9) and Price (29) have used the word as the unit. At first, this seems satisfactory; but words differ much in length and hence certain ones will require a longer time for pronunciation than others. It has been suggested by some that the syllable might be used as the unit, but reflection shows that the syllable is open to the same objection as the word. Others have suggested that the line be used, but since this is not standardized it is not practicable. In view of all of these facts, it seems that the word as a unit of oral reading is most practicable, and probably it will continue to be used for some time. In support of this, there is considerable evidence to be found in eye-movement records for oral reading that such reading proceeds by words rather than by the larger units used in silent reading.

Language Ability Involved. Successful reading involves a fluent and ready usage of language. This ability divides itself into two parts, as follows: (1) the knowledge of individual words, and (2) the ability to deal with these words when they are found in connected discourse.

The first point may be objected to on the basis that words are often known because of their context, and that, therefore, it is not necessary to know them individually. While this may be true for a limited number of words, the greater part of the words in any passage must be known out of context. This is especially true where shades of meaning are involved. Not only is it important to be able to recognize words, but it is also essential that the reader be able to deal with new words. The importance of such a process comes from the fact that the child is constantly coming in contact with strange words. If he is to be self-helpful, he must have certain methods at hand by means of which these unfamiliar words may be attacked. Such ready recognition of words is usually established by drill upon sight words, while the principles of phonics give the child ability to deal with new words.

TESTS DEALING WITH INDIVIDUAL WORDS

Two tests have been devised for measuring the vocabulary of children. Jones (14) has selected lists of words from ten primers on the basis of the number of times the different words are used in the various texts. To illustrate, the word "and" was used 704 times, and the word "drink" 34 times, while the word "dash" was used only one time.

In taking the test, the child is provided with a list of 192 sight words and 118 phonic words. These words appear in columns, and the subject is expected to pronounce them in order. Every word which is not recognized or which is stumbled over is indicated on the teacher's check card. Three methods of scoring are given. The one used and recommended by Jones involves large numbers and, without the use of an adding machine, would be tedious.

The directions for giving the test are simple and easily understood. There seem to be no difficulties in administering the test, and it is printed in a simple and convenient form. Jones recommends that testing be discontinued with a class if it averages above 90 per cent. Another point made by this writer is that if a first-year class stands above 90 per cent it has had too much drill. Further than this, he thinks that any third grade ought to be able to make a score of 95 per cent.

Haggerty (10) has criticized this test of Jones rather severely in the following terms:

> It might be correct to penalize a child 622 points for missing the word "man" and only 104 for missing the word "cap," if the coefficient of one's vocabulary were directly proportional to the number of times he had seen the word. Or it might be considered a more serious deficiency not to know "man" because in the future he would meet it much more frequently and, therefore, his deficiency would appear to plague him more often. The latter alternative can hardly be in mind, because the frequencies given are not for the number of times the word is yet to be experienced. They refer only to what has been. Probably the first assumption is, therefore, the one upon which the method is based, but for the words in Mr. Jones' list, this assumption is far from true. Our test shows that the children knew "be" as well

as "who," but the frequency of the former is 122 and of the latter is 111. "The," with a frequency of 5,129, was just as well known and no better than "too" with a frequency of 142. If the proposed method of scoring were to be applied with any degree of accuracy, we should have to know the exact number of repetitions required to learn every word used in the test. This we do not know. The figures given represent frequencies far too few for many of the words; for others, the amount of "overlearning" is so great that the number of frequencies is out of all proportion to the result. We should also have to know whether the child in question had met the word approximately that number of times. This we might assume if we knew the books studied and the general method followed.

Haggerty (10) has also devised a scale for measuring the vocabulary of children in the first, second, and third grades. It consists of a set of phonetic words and a set of sight words. The words have been evaluated so that the test is made up of lists of words of the same degree of difficulty. The test is easy to give and the scoring is not difficult.

The fundamental difference between the test of Jones and that of Haggerty is worth noticing. Both authors have attempted to evaluate different words. The method of Jones with its difficulties has already been pointed out. Haggerty's method is based upon the number of errors made by children who pronounce the various words. This method requires very careful interpretation of results. This is necessary because the difficulty which a word presents to a child depends upon the practice which the child has had with it. It is a well-known fact that, in any kind of learning, the effect of the early training produces greater increments than does the later training. This is usually expressed by saying that there is a more rapid progress made in the earlier periods of learning than in the later stages.

Applying this principle of learning to the case in hand, one will see that differences in words in the early stages of the child's experiences with them will depend to such an extent upon practice that care must be exercised in determining whether it is differences in the difficulty of words that is being dealt with or whether it is differences in practice that produce the results.

The need for such a distinction decreases after the limen of "being just able to recognize the word" is reached, and continues to decrease until the word is learned perfectly. Haggerty has anticipated this difficulty in his discussion, as follows:

> Whether or not these words will maintain the same scale value in further testing will depend chiefly upon whether the children to be tested have met these words and phonograms in their reading the same number of times as had the children from whom these scale values were derived.

It is also true that most, if not all, of the tests in reading are better adapted to deal with the reading habit, after the habit has been established, than to deal with reading in its very early stages. Attainment in this subject involves both practice and ability; and since practice has its greatest effect in the early stages of the training, differences in performance at this time may be due entirely to differences in practice. In the later stages of learning to read, the effects of differences in practice are not apt to be so great; hence the test becomes more nearly a test of abilities which are fundamental to attainment.

TESTS DEALING WITH WORDS IN CONTEXT

The discussion will now pass to a treatment of those tests which are concerned with the recognition and pronunciation of words in connected discourse. This involves two elements: the rate of reading and the ability to pronounce words.

The first test to be considered here is one devised by Price (29). It consists of two selections for each of the school grades from the second to the eighth, inclusive. The first of these passages in each case is to be given to a grade in the early part of the school term and the second at the close of the term. The two selections for each grade are not of the same difficulty, but they have been weighted so that the final results are comparable. No details of the method by which this weighting is done are given. The passages in the test apparently vary in difficulty from grade to grade, but no statement is made concerning these differences. The time allowed for reading in each case is one minute. The test is given individually and two examiners are recommended. One of these makes a record of the time and the second one records the errors. The author does not suggest the use of a stop-watch, which simplifies the keeping of time so much that one person could give the test with little difficulty.

The directions to both the teacher and the pupil are explicit and simple. In the directions to the children it is said that the purpose of the test is to determine how rapidly and accurately they can read. It may be that this emphasis on speed tends to increase the rate at which the children read during the test, while if some more general expression had been used, such an increase in rate might be obviated.

The errors taken into consideration are miscalled words, words put in, words left out, and transposed words. Repetitions are not recorded, because such errors are counted against the child in loss of time. Any mistake corrected by the child is not recorded as an error. The types of errors are first indicated by different symbols upon scratch paper. Later, each type is totaled and recorded on the score sheet. It would be much better if each mistake was indicated on a duplicate copy of the test and kept as a permanent record, because the mere number of errors is not the only important thing to be thought of. The psychology back of the errors is highly important, and any test should interest teachers in a detailed study of the records made.

For the same reason, repetitions should be recorded. It may be true, as Price contends, that to count a repetition as an error is to count it doubly against the pupil, for the repetition necessarily lowers the rate. However, it should be emphasized that the reason for the repetition is important, and some record of such mistakes should be made.

The scoring of the test involves numbers in the thousands. Such numbers do not mean much to teachers, since they use, for the most part, a system of grading composed of numbers below one hundred. The test is printed in a convenient form, and numbers are provided in a column at the right showing the number of words in the selection up to the end of each line.

The second test to be considered in this connection is by Gray (9). This test consists of twelve short selections varying in difficulty from very easy to difficult. The steps in difficulty have been carefully evaluated. The method by which this evaluation is made will be discussed later. Specific directions for giving and scoring the test are printed on a sheet separate from the test. The process of scoring is somewhat involved, but the final results are expressed in small numbers and are easily manipulated. In giving the test, there is always a short pause between the time that one selection is finished and the time that another begins. Under such conditions constant watching is required to keep the child from looking over the selection to be read next. Some change in the printed form of the test which would eliminate this difficulty would improve the test.

Two types of data are recorded. These are the amount of time for reading each selection and the errors. The errors considered are omissions, repetitions, substitutions, insertions, and gross and minor errors in pronunciation. Such errors are recorded on a duplicate copy of the test. These duplicates serve as valuable reference material for the future work of the teacher.

The chief difficulty which attaches to the use of this scale for diagnosis is the determination of rate. Before this can be done accurately, standards for the different paragraphs will have to be established for each of the several school grades.

Both the Price test and the Gray test combine rate and quality into a single item. This is done upon the assumption that, if both factors are present in a high degree, a combination of them can be made to indicate a similar fact; if one factor has a high score and the other a low score, a combination will indicate the same; and if both elements are scored low, this would be indicated by the combination. This method has the distinct advantage of simplifying the results, but makes it impossible to compare in any thoroughgoing way two scores which are numerically the same. For diagnostic purposes the method is undesirable, because in this type of work it is necessary to know which factor is low and which is high.

The different passages which constitute the test vary as to their difficulty. It is evident that a complete interpretation of the results obtained by this test would require that the factors in the passages which make for differences in difficulty be fully understood. Courtis (6) has studied the test from this standpoint. He criticizes the scale because it seems to contain certain pitfalls which it is very difficult for the untrained reader to avoid. A quotation from his discussion will make this point clear:

> Paragraphs 2, 3, and 4 have for the first word "once"; "Once there was," "Once there were," "Once there lived." Paragraph 5, however, begins "One of the most interesting birds." Child after child, influenced by the preceding paragraphs, begins: "Once of the." Thus in Class 11 Jefferson out of 40 children, 5 missed on this particular point. Tabulation of other classes yielded similar results. In general, one child in 10 is so susceptible to the habit-forming influence of the succession of "onces" that he will misread "one" in paragraph 5. In other words, in working with the scale one gains the impression that the difficulty of certain paragraphs of the scale is in part caused by the occurrence of certain traps or pitfalls, rather than by real increases in the difficulty of the reading.

Other points of view from which the scale is studied by Courtis is the increase in difficulty of vocabulary, in length of sentence, in difficulty of sentence structure, and in content of material. The discussion of these various points is very brief, and the conclusion is reached that the causes of the increase in difficulty from paragraph to paragraph is little understood.

A summary of the discussion thus far is now in place. The six general statements which follow will serve for this:

1. The term reading ability has two different meanings.

2. The measuring of reading ability involves certain difficulties fundamental to the reading process.

3. Knowledge of the reading process and experience with other types of testing make certain demands of all reading tests.

4. Oral reading may be considered from four different standpoints.

5. No attempt has been made to measure certain phases of oral reading, nor have all methods used in other cases yet been standardized.

6. There are tests extant which measure oral reading ability to deal with individual words or with words in connected discourse.

SILENT READING TESTS

Tests of this type may be divided into two general classes: (1) those which deal with a knowledge of individual words, and (2) those which are concerned with the general problem of interpretation. The first kind of test is usually spoken of as a visual vocabulary test. Such a test has been devised by Thorndike (34). It consists of different series of words, which vary in difficulty. The difficulty has been carefully scaled. The test is printed in a form which makes it easy to administer and easy to score. Such a test is highly important from the standpoint of diagnosis, because the ready recognition of words is fundamental to all reading ability. Another vocabulary test has been devised by Pressy and Skeel (28).

Silent Reading Tests which Involve Interpretation of Connected Material

In evaluating this type of reading, two factors must be taken into consideration. These are rate and comprehension.

Rate of Silent Reading. The rate of silent reading is different from the rate of oral reading, in that there are no physiological limits placed upon it. Silent reading is an individual matter and the rate depends entirely upon the reader's own mental activity. If the reading activity of a child is such that all phases of comprehension take place easily and readily, it is possible for such a pupil to develop a rapid rate of reading, because the degree of rapidity is entirely a subjective matter and has no relation to any objective factors, as in oral reading. The rate of silent reading, then, is an index of comprehension, and it is for this reason that it is considered important in the study of reading.

Unit of Rate of Silent Reading. An important problem arising in dealing with rate is that of the unit in which it is to be expressed. Logically, this problem should be approached in terms of the unit by which silent reading proceeds. The difficulty encountered here is that experiments show clearly that the unit of silent reading is not fixed, but that it varies with different readers and with the same reader from time to time. When easy and familiar material is used, the reading activity of an experienced person may proceed in units as large as phrases or short sentences, while under other conditions the reading of the same person may proceed by words or syllables. In the case of the untrained and inexperienced reader, it is very doubtful if the unit of silent reading is ever greater than the word. In view of these facts, the unit usually selected by investigators is the word. Such a unit should be thought of as meeting the conditions only in a very general way.

Comprehension in Silent Reading. Comprehension of this kind is an exceedingly complex and highly specialized activity. It is well understood that all reading involves the simpler processes of sensation and perception, but it needs to be emphasized that, in addition to these, many types of reading require most of the higher mental processes, such as judgment and reason. This means that the problems involved in testing and measuring comprehension are difficult and complex.

Methods of Testing Comprehension. An approach to this phase of the problem may be made by raising the question as to what tests of comprehension the school uses. The schools are, to a very large extent, reading schools, and as a result they use tests of comprehension of various types. A complete catalogue of these various tests would be difficult to make, but among those used are the following: (1) cral and written questions,

(2) oral and written reproduction, (3) outlining, (4) drawing, (5) dramatizing, (6) emotional reactions, and (7) direction tests as seen in assignments. Of this list the written question, written reproduction, outlining, and the direction tests have been used as methods of testing comprehension in silent reading by different investigators.

THE QUESTION AS A MEANS OF TESTING COMPREHENSION

The question is probably used more frequently in the school than any other method of testing comprehension. It is used in all subjects of the curriculum and by all teachers under most of the conditions which arise in teaching. Any test for silent reading which is based upon the question places children in a familiar situation, so that the most of their time and energy goes into the interpretation of the material submitted to them and not into adjusting themselves to the situation. Another important value of the question is that it always starts a train of associations, and as a result the child is not left to react in a perfectly spontaneous manner. Another point of more doubtful value is that the question does not involve all the passage read. Usually there are sufficient questions to cover only the main points of a passage. Usually there is little, if any, relation existing between the questions, and the memory involved is necessarily somewhat mechanical in its nature. But, on the other hand, the question involves only a limited language ability, since it can be answered in many cases by one or two words; and finally, it is fairly easy to score and so lends itself well to testing.

An important limitation of the question as an instrument for testing reading lies in the fact that it tests some capacity in addition to the ability to read. This additional element is the ability to answer the questions themselves, which is a highly specialized ability, including, as Thorndike (33) says, "all the features characteristic of typical reasoning." For example, two pupils may actually possess equal ability to derive meaning from the printed page, but one may score above the other because he more readily grasps the meaning of the question presented or more easily formulates his replies to them. However, the specific ability involved may be improved by practice, which would reduce, if not remove, the limitation. If this view is accepted, then tests based upon the question must be regarded as tests of a specialized form of reading ability and not as tests of general reading ability.

Existing Tests based upon the Question as a Means of Testing Comprehension

Tests involving the question have been used by the following authors: Courtis (5), Fordyce (7), Gray (9), Kelly (17), Monroe (22), and Thorndike (35). Among the tests one finds at least three types of questions used. These are factual, puzzle, and direct questions. Fordyce, Gray, and Thorndike use the first type; Kelly and Monroe make use of both the first and second kinds; and Courtis uses the last. In the use of all these types, the authors strive for questions the answers to which may have but one interpretation. This characteristic is essential to the objectivity of tests, the necessity for which was pointed out in an early part of the discussion. In the case of the factual question, it is easy to see that answers may be given which would be highly ambiguous. This difficulty in interpretation has been obviated in certain cases by listing answers which may be considered as standards. With even this precaution, however, there yet remains room for doubt as to the meaning of some answers.

The puzzle question as used by Kelly and Monroe is objective in a large degree. This objectivity probably results from both the type of question and the material used. These authors have published also a list of answers which serve as an aid in evaluating the results for certain questions about which there may be some doubt.

It will be seen that a direct question can be made most objective, for there are just two answers which can be given to such a question. These are "yes" and "no." To make perfectly sure that no doubt will arise, Courtis publishes a list of answers. The difficulty here lies in the fact that the pupil may guess at every question and yet may get fifty per cent of the answers correct. This problem has been taken into account by Courtis in his method of scoring. The plan used amounts to doubling the number of incorrect answers.

Other points concerning each of these tests may now be given.

The Courtis Test. This test is published in a very convenient form, and detailed directions for scoring are given. The method of scoring is not elaborate and requires little or no knowledge of statistical work. The test uses as material a story of seventy lines. In giving the test, the teacher has the child read the entire story first. It is then read again in sections of five or six lines each, and five questions are asked upon each of the sections. This second reading of the material introduces an element into the results which is different from that used by other authors. Nothing is said concerning the relative difficulty of the various sections and a survey of them leads to the conclusion that they do not vary much. In this case, reading ability is measured by the amount read rather than by variations in the difficulty of the material.

The Fordyce Test. This test is published in a form which is convenient to use. There are two passages used. The first is for the third, fourth, and fifth grades, and includes thirty-two lines. The second selection is for the sixth, seventh, and eighth grades, and includes forty-five lines. The directions for giving the test are ample and can be followed easily. The scoring is simple, and answers to the questions, along with their relative weights, are published.

In determining rate this author allows a definite time for the reading by each grade. This time is based upon standards established by Starch and others. When it is considered that Starch used an entirely different method of testing reading and employed very different material, a question may be raised as to the validity of applying his standards to this test.

In carrying out the test, the examiner calls time while the pupil is in the midst of his reading. The directions require that he mark the word at which he is reading when time is called, and then proceed as before to the end of the selection. It is very probable that such directions have a decided influence upon the reading rate. A carefully checked experiment made by a colleague of the writer showed a very decided tendency to increase the rate of reading when directions of this sort were given. The score for rate and the score for comprehension are expressed separately.

The Gray Test. This test is published in a form which lends itself to use for individual testing. If careful directions for giving and scoring the test, along with typical answers to the questions, were published, the test would be much more serviceable. Three passages are employed. The first is used in grades two and three; the second is given to grades four, five, and six; and the third is used in grades seven and eight. Ten questions are given on each selection.

The same selections are used by this author as a basis for a test by means of reproduction; that is, the same pupils deal with the same passages from the standpoint of reproduction and of answering questions. Just what effect this procedure has upon the results is not easy to determine.

The form in which the test has been printed is a very great aid in getting the rate accurately in individual testing. The selection appears in three columns on a piece of cardboard. When the eyes of the reader are raised from the bottom of the first column to the top of the second column, time may be noted; and when the eyes are raised from the bottom of the second column to the top of the third, time may be noted again. If this is done carefully, the time for reading the middle column may be had accurately. The scores for rate and comprehension are expressed separately.

The Kelly Test. This test has been worked out in a form which can be used very easily by teachers. The directions for scoring are printed on a sheet separate from the test, while the directions for giving the test are printed on the first page and are to be read by the pupils and the teacher together.

The test consists of a series of short paragraphs which are in no way related to one another. Not only are they unrelated, but they apparently call for very different types of comprehension as well as specialized abilities of different kinds. The several passages have been carefully graded in regard to difficulty, both as to rate and comprehension. This allows for a test both by the amount read and by the difficulty of the material read.

The two factors, speed and comprehension, have been combined into a single index for each passage, and the final score is the sum of the indices for the passages correctly read. Such a method of scoring is exceedingly simple and is easily carried out.

The total time allowed for the test is five minutes. This, within itself, is ample; but when the very short passages are considered, it will be seen that the time for most of the selections is under the limit set by Starch.

The Monroe Test. This test is very similar to the Kelly test. One difference lies in the fact that the several selections are given both a rate value and a comprehension value, while in the Kelly test these two factors are united into a single index. A second difference is the types of material used. Many of the selections in the Kelly test deal with topics which are entirely new to the pupil. Results obtained in this manner could hardly be thought of as a true measure of reading ability. Monroe has obviated this difficulty by using, for the most part, material of the same kind as that which appears in school readers.

The Thorndike Test. This test has been published in a form which is very usable. The technique of giving the test is simple and the scoring is not difficult. A set of answers which help in evaluating the answers of children is given. The test consists of a series of selections not in any way related to each other. These are of different degrees of difficulty. Each selection has been carefully graded in this regard.

The directions give the child the opportunity to read a selection as many times as necessary, in order to be able to answer the questions. The rate at which a child reads is not taken into consideration. A test which neglects rate is often spoken of as a difficulty test, while those which take this element into consideration are referred to as rate tests. It is urged against the rate tests that there are many factors which affect performance from the standpoint of rate. Therefore, unless very great precautions are taken, results which involve rate may be inaccurate. On the other hand, if rate is neglected, it appears that one element which makes for inaccuracy in testing has been eliminated, and that data obtained in this manner are therefore more reliable. There are those who hold that all tests should be of the difficulty type.

REPRODUCTION AS A TEST OF COMPREHENSION

Reproduction as a method of testing comprehension is used by the school to a very great extent. This method probably stands next to the question method in the number of times that it is employed. Only one form, written reproduction, has been used by investigators in reading.

As a method of testing reading, this type of work is one with which the children are familiar, so that probably little, if any, of their energy goes into adjusting themselves to the situation. The written product is obtained in a free and spontaneous way and does not depend upon trains of thought suggested by questions, or by any other means. This involves memory to a large degree, although it may be thought of as logical memory, since the test usually requires the reproduction of a story. Language ability is also involved to a considerable degree. Hence, the subject who has ability to write readily and fluently will do much better in a test of this sort than will one who does not have such ability. The fact that the reaction is somewhat long either makes the test long or reduces the amount of material read.

The greatest difficulty in connection with this method is found in the scoring of the results. This raises the question as to what a perfect reproduction is, and how near any one reproduction comes to perfection. Different methods for obviating this difficulty have been used. Starch used the number of words reproduced in relation to the number of words in the selection. This involves the elimination of certain words or phrases from the reproduction which are irrelevant, and thus introduces a variable factor into the results because of differences of opinions. Other authors have used the method of dividing the original selection into units of thought and giving credit for the number of these units reproduced. This method has probably been used more widely than any other. Kallom (16) and Gray (9) have compared reproduction and the question as a means of testing comprehension. Gray concludes that the question is superior to reproduction and Kallom's results show that one is as good as the other.

Existing Tests Based upon Reproduction

Brown's Test (*2*). This test has been published in a monograph which gives results obtained by using it. Both the technique and the directions for giving it are simple and easily executed. Only one selection is used, so that the test depends upon the amount of material read rather than upon varying degrees of difficulty.

The scoring is done by dividing the original selection into units. These units are indicated in the monograph. The results for rate and reproduction are combined into a single score.

Gray's Test (*9*). The same selections as mentioned in this author's test by means of questioning are used for reproduction. The method employed in scoring consists in eliminating first of all the irrelevant matter. The remaining material is evaluat in terms of the number of words reproduced correctly. T scores for rate and comprehension are expressed separately.

Starch's Test (*31*). This test is printed in a form whic makes it usable. The directions for giving it are simple. Th test consists of a series of selections of varying difficulty, bu the difficulty of the passages has not been carefully scale The time allowed for reading is thirty seconds, and the scores fo rate and comprehension are expressed separately.

OTHER TESTS OF READING ABILITY

There are certain other tests which should be mentioned that are not so well known as those just discussed. The school requires other types of reading than those for the purpose of answering questions or reproduction. Among these are very rapid reading, skimming, reading in response to certain directions, and reading for the purpose of outlining.

Skimming Tests. For skimming, the writer (8) has used a Newspaper Test in which the child is required to find a given article in a paper as quickly as possible. This test has the advantage of requiring a reaction which does not involve language ability. It is of such a nature that the rate cannot be expressed in words per second, but has to be expressed as the total number of minutes or seconds required for the test. No standards have been published.

The Direction Test. This test has been used by Thorndik (35). It consists of a series of simple directions for doing simpl things. The child is accustomed to direction in his assignments which may be either oral or written. In spite of this, the situation presented in the Thorndike Test is somewhat novel, and no doubt, the child may be confused by it. The reaction doe not depend upon language ability, and memory is involved i only a small degree. The material read is simple and the interpretation apparently does not require the same mental activitie as are involved in other types of reading. The test is of suc a nature that no measure of the rate, as a separate factor, can be made. Pintner and Toops (27) have used this test with a large number of children and have published norms for ages ranging from seven to seventeen years. A carefully prepared test by Burgess (3) may be classified under this general heading. The test is composed of a series of passages of equal difficulty and the response called for by the various processes are very similar. Care has been taken to control vocabulary difficulty, word arrangement, print, etc. A series of tests of increasing difficulty similar to this could be devised which would aid in solving the difficulties encountered by various authors of reading tests and at the same time such a series would meet the objections raised by Miss Burgess.

Outline Test. This test stands between the question test and the reproduction test in that nothing is given to start a chain of associations, and yet the reaction is not so extensive as that required in reproduction. The writer's (8) use of it has shown that it requires the evaluation of the material read, and success with it apparently depends upon the training given by the school.

The Haggerty Tests. These tests vary the type of response and are, therefore, difficult to classify in the preceding scheme. The Sigma 3 test (12) makes use of a vocabulary test, a sentence test, and a test composed of connected material. Each type of material varies in difficulty. The response called for in the last type of test requires the selection of the proper response from a series of responses. The Sigma 1 test (13) is for use in grades 1–3. It involves material which varies in difficulty. The responses are based upon the direct question, the direction test, and the choice of the correct response from a series of responses.

A summary of the discussion upon silent reading tests is now in order, as follows:

(1) The unit of the rate of silent reading is a variable, and only as it meets a practical situation is the word a valid unit.

TABLE I — SUMMARY OF READING TESTS

Test	*Response*	*Time*		*Rereading*	*Difficulty of Material*		*Type of Material*
		Total	*For Each Passage*		*Varies*	*Scaled*	*Subject Read*
			ORAL READING TESTS				
Gray	Correct Pronunciation	Varies	Recorded	None	Yes	Yes	Disconnected passages
Price	Correct Pronunciation	Fixed		None	Yes	No	Single passage Varies for grades
			SILENT READING TESTS				
Brown	Reproduction	Fixed		May occur in part	Apparently within the passage	No	Single passage
Burgess	Following Directions	Fixed	May vary	Nothing to prevent	No	Yes	Disconnected passages
Courtis	Answering Questions	Fixed		Required	Apparently within the passage	No	Single passage
Fordyce	Answering Questions	Varies	Recorded	May occur in part	For different grades	No	Single passage Varies for grades
Gray	Reproduction Questions	Varies	Recorded	May occur in part	For different grades	No	Single passage Varies for grades
Haggerty Sigma 1	Directions Questions	Fixed	May vary	Nothing to prevent	Yes	No	Sentences Disconnected passages
Sigma 3 Test 2	Questions	Fixed	May vary	Nothing to prevent	Apparently	No	Sentences
	Choice from						

TABLE I — SUMMARY OF READING TESTS — *Continued*

Test	*Response*	*Time*		*Rereading*	*Difficulty of Material*		*Type of Material*
		Total	*For Each Passage*		*Varies*	*Scaled*	*Subject Reads*
SILENT READING TESTS — *Continued*							
Kelly	Directions Questions	Fixed	May vary	Nothing to prevent	Yes	Yes	Disconnected passages
Monroe	Directions Questions	Fixed.	May vary	Nothing to prevent	Yes	Yes	Disconnected passages
Starch	Reproduction	Fixed		May occur in part	Yes	No	Single passage Varies for grades
Thorndike	Questions	Not considered	Not considered	Suggested	Yes	Yes	Disconnected passages
PRONOUNCING VOCABULARY TESTS							
Haggerty	Pronunciation of words	Not considered			Yes	Yes	Isolated words
Jones	Pronunciation of words	Not considered			Yes	Yes	Isolated words
VISUAL VOCABULARY TESTS							
Haggerty Sigma 3 Test 1	Definition of words	Fixed			Apparently	No	Isolated words
Pressy and Skeel	Recognition of words	May vary			Apparently	No	Nonsense syllables Sense words
Thorndike	Definition of words	Fixed			Yes	Yes	Isolated words

(2) There are several different methods of testing comprehension, which are used by the school. The two methods most often used in testing reading ability involve written questions and written reproduction. Each of these methods has its distinct difficulties and its marked advantages. (3) The various reading tests are compared in Table I.

It is evident from the preceding discussion of the various tests that the measurement of reading ability will be still further refined in the future and that more accurate results will be compiled. Any diagnosis which is undertaken at present is not to be considered as final. Diagnosis cannot outdistance analysis; but, as analysis is extended and made more detailed by means of tests and experiments, diagnosis will become more and more reliable.

UNIFORMITY OF AIMS AND RESULTS OF READING TESTS AS A MEANS OF JUDGING THEIR ACCURACY

One method of evaluating tests has been set forth in the criteria at the beginning of the chapter. The writer, in dealing with the present problem, proposes to study the aims and results of various tests to determine whether they are in reality measuring reading ability, and if they do measure this process, to determine whether the measurement is accurate and reliable.

Otis (24) argues that the present tests are not altogether reliable, because different writers are apparently working at cross purposes. In support of this he quotes the function of different tests as stated by their authors. Such statements seem to indicate that investigators have different conceptions of the process of reading, and that the tests do not measure the same thing. Another view of this matter is that reading is a very complex activity, and that the various authors are attacking it from different points of view. When one author states the purpose of his test in terms of reproduction, and another in terms of answering questions, they are both interested in interpretation as found in the reading process, but they are dealing with it from different standpoints.

The same point is brought out in other fields of mental testing. Each test measures a different mental function, and the purpose of such tests may be stated in very different terms; yet the question of what mental activity is, is seldom raised. In other words, it is recognized that mental activity is highly complex and that each mental test is aimed only at one phase of it.

Otis also argues that before progress can be made it will be necessary to decide upon some definition of reading ability. The definition which he proposes is as follows:

> It would seem then that reading ability, to be defined logically, must be considered as embodying in essence only those mental processes which are concerned in reality with the specific visual symbols as such. Other mental activities involved in the total reading complex may be spoken of as "supra-reading" or the accompaniments of the reading process.

If this view is accepted, the fact remains that these "supra-reading" activities are involved in the actual reading processes and, evidently, children vary in them as well as in this essential phase of reading outlined by Otis. If such differences do exist, it seems necessary to study them. Even if the correlation between the essential elements and the supra elements is very high, there would be certain pupils the results from whom would show a lack of correlation and would, therefore, need detailed study.

Richards and Davidson (3) argue much the same as Otis. The following quotation is taken from their work:

> The variety of currently used reading tests gives concrete evidence of the lack of a corresponding definition of reading ability and of the difficulty of formulating one.

Further on in their discussion, these authors assert that the blanket term "reading test" should not be used. The same authors have given various reading tests to different groups of children and from these results have derived the correlations[1] shown in Table II. This table indicates a correlation of .38 between the results of the Trabue Test and the vocabulary tests, and equally low correlations for the results of the other tests. These indicate to Richards and Davidson a disparity in the abilities which the tests are measuring; and since the tests apparently measure different abilities, these authors imply in their statements that the tests are unreliable. To argue that reliability means conformity in results is a doubtful procedure, unless reading is only one thing, and is that one thing under all circumstances. So long as we have oral and silent reading, slow reading and fast reading, and reading with different purposes and aims, it is doubtful whether uniformity of aims and results in testing reading ability will be attained. It is probably true that some common element runs through all types of reading and that a test as suggested by Otis is desirable, but it is exceedingly doubtful if such a test will replace all the reading tests used at present.

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[1] For an explanation of this term along with other statistical terms, see Appendix A.

TABLE II — TABLE OF THE AGGREGATES OF COEFFICIENTS

Showing Correlations existing between Results for Various Reading Tests by Richards and Davidson

	V	T	N	K	S	Sum
V	—	38	36	39	33	1.46
T	38	—	42	38	28	1.46
N	36	42	—	32	30	1.40
K	39	38	32	—	25	1.34
S	33	28	30	25	—	—1.16
Sum	1.46	1.46	1.40	1.34	1.16	

T = Trabue
V = Vocabulary
N = Narrative Completion
K = Kelly
S = Starch

Starch (32) has also attacked the problem of the reliability of reading tests by giving the same tests a second time after an interval of six weeks. With one exception, these correlations vary from .60 to .82. Another method used by this author consisted in comparing the uniformity of the scores obtained in the successive use of the tests with the uniformity of teachers' marks in estimating the same examination paper. He also compared the mean variation derived from the successive use of the test and the mean variation derived from the teachers' marks. From these two groups of results Starch concludes that a single application of any one of the three reading tests used is probably from three to five times as reliable as the mark given to a piece of work by a single teacher.

This author also finds the average correlation between results obtained by three different tests to be as follows:

Kansas (Kelly) and Thorndike	.53
Kansas (Kelly) and Starch	.53
Thorndike and Starch	.40

These coefficients are much higher than those found by Richards and Davidson. This disparity in the two groups of data is explained by Starch as due to the fact that the correlations of Richards and Davidson were based upon single measures. The results obtained by Starch indicate to him a high degree of reliability for the reading tests used. The number of cases used in determining his correlations are very few, and it is doubtful whether his results can be accepted as giving a final solution for the problem.

Still another author interested in the problem of reliability of reading tests is Breed (1). This investigator gave the Thorndike and Starch tests to four hundred sixth-grade children. These pupils were divided into nine different groups. The correlations found between the comprehension scores for the two tests in the various groups are shown in Table III.

In commenting on these results, Breed says:

> Furthermore, on account of the variety and complexity of mental functions involved in comprehension, functions varying from the simplest association that yields a meaning to the subtlest selective thinking, it seems clear that each test might measure some phase of comprehension, yet not the same

TABLE III

Showing Correlations between the Results for the Thorndike and Starch R
Tests, by Breed

GROUP	CORRELATION
A	.38
B	.19
C	.26
D	−.26
E	−.01
F	.03
G	.16
H	.05
I	.26
Average	.11

The conclusion to be reached from the discussion of tl liability of tests is that the present reading tests are each able for measuring a particular phase of reading ability that no single test should be taken as indicative of all p of the reading process. As has been suggested, reprodu and answering questions as methods of testing comprehe both have fundamental difficulties. These difficulties back to the degree of memory, language ability, etc., inv in the response. From this, it would seem that the relia of these methods of testing reading would have to be stat terms of the amount of memory and language ability invc rather than in terms of the variability of the results obt by such tests. Two methods may agree in results and y very unreliable tests; or they may disagree in the results g and yet be very unreliable, because they may be testing different phases of reading ability.

CHAPTER III

A SURVEY OF SOME OF THE RESULTS OF READING TESTS; DIAGNOSIS BASED UPON READING TESTS AND THEIR RESULTS

The preceding discussion has indicated certain fundamental phases of reading ability. These various factors will not be discussed from the standpoint of the results obtained by the different tests previously treated.

KNOWLEDGE OF WORDS

This problem will be dealt with from two points of view: (1) errors in oral reading will be studied, and (2) the results from Thorndike's word test will be considered.

Errors in Oral Reading. Such tests as Gray's and Price's make it possible to study in detail the errors which children make in oral reading. Such a study has been made by McLeod (20). His results are summarized in Table IV. This table indicates clearly that gross mispronunciation is the most common error for the first grade, while substitutions are next in order.

In the second grade, substitution is the most characteristic form of errors. McLeod is of the opinion that this change in the type of error may be due to a change of method in the reading used by the first and second grade children. The change depends upon a shifting of attention from the individual word to groups of words. A second suggestion given by this author is that at this stage, as well as in the third and fourth grades, the pupil has a limited knowledge of a large number of words, but that this knowledge is not sufficiently intimate for him to be certain of his recognition.

In the third and fourth grades, minor mispronunciations assume second rank. This type of error, according to the author, occurs more often than gross mispronunciations, because the child is beginning to use his ability to analyze words, and this ability makes his pronunciation correct in most respects. The table shows, furthermore, that in grades five, six, seven, and eight the relative frequency of the various types of errors is much the same.

In studying the omissions, repetitions, insertions, and mispronunciations in the reading of a small number of pupils distributed through the various school grades above the third, the writer (8) found that the only error which was reduced to any great extent through these grades is mispronunciation. Diagram III shows the decrease effected in omissions, and Diagram IV shows the same facts in regard to mispronunciations. The height of the rectangles indicates the number of errors, and each rectangle represents one pupil. These diagrams show that there is a very large decrease in the number of mispronunciations after the fifth grade, and that the decrease in the number of omissions through the grades is very small. Such facts indicate clearly that it is either relatively easy to reduce mispronunciation, or that the training of the school is centered upon errors of this type, while errors of other kinds are either hard to eradicate or the training is not effective.

TABLE IV

Showing Relative Frequency of Various Types of Errors in Oral Reading, by McLeod

GRADES	I	II	III	IV	V	VI	VII	VIII
Gross mispronunciations	44.8	23.8	18.1	11.6	13.8	16.7	11.8	10.5
Minor mispronunciations	1.9	3.8	23.2	21.8	32.0	36.3	31.4	41.9
Omissions	1.6	5.2	4.9	8.0	4.7	9.0	8.2	4.7
Substitutions	31.9	36.9	28.2	30.8	24.6	20.6	26.4	18.9
Insertions	4.7	4.4	11.1	7.5	6.6	6.1	8.8	7.0
Repetitions	15.1	25.9	14.2	20.2	18.1	11.1	13.2	16.8

Repetitions. In some unpublished work upon mistakes made by the first, second, and third grade children, the writer has found that the most common error in the first grade is the repetition and that this rapidly decreases in the latter portion of this year. There is also a considerable decrease of this type of error in the second grade and in the early part of the third grade. The apparent discrepancy in these results and those of McLeod may be due to the fact that McLeod's data were procured by means of a test in which there was much

Diagram III

Showing Distribution of Omissions through Various School Grades

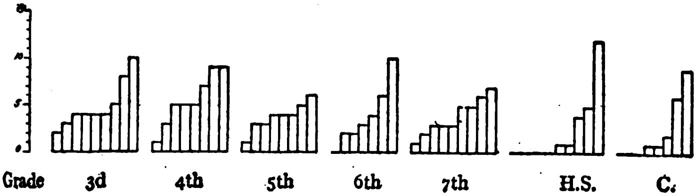
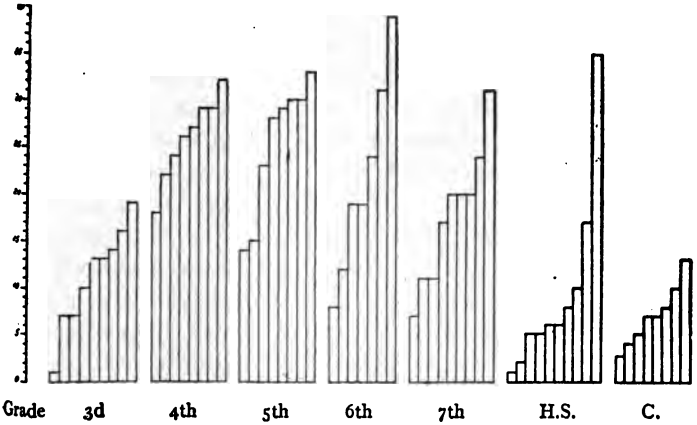


Diagram IV

Showing Distribution of Mispronunciations through Various School Grades



variation in the difficulty of the passages read, while the writer's results were compiled by listening to children read in their daily reading classes.

In the early periods of a child's training, repetitions may result from dissatisfaction with his own results. This may indicate a lack of understanding of the passages repeated or a failure to give proper expression to it. In other cases, the reader may pause on account of an unfamiliar word, and after the word is comprehended he may repeat certain words closely related to it in order that there may be no break in the reading.

If repetitions are found to any great extent in the upper grades, it is probable that the habit of repeating has been carried over from early periods of learning. This explanation would not apply, however, in the case of very poor readers in the upper grades.

Omissions. This type of error seems to be of two kinds. First, words which are absolutely essential to the meaning are omitted, and second, words which play a secondary part in the meaning are left out. The former usually occurs in very poor reading, while the latter may occur in either good or poor reading. In the former case, the understanding of the reader is so poor that the omission makes no difference in his understanding; while in the case of the good reader, omissions may mean that he already has the general meaning of the passage in mind, and so leaves out certain modifiers or other expressions not essential to the meaning.

Insertions. A study of a limited number of insertions reveals two types of such errors. First, there are those which have no relation to the material read, and second, there are those which make perfect sense. The former may be due to lapses of attention, so that material from the margin of the field of consciousness distracts the attention or in some cases such insertions may be made because the child under the pressure of the occasion continues to say something. The second form of insertion is usually a word which might modify some word in the passage being read, and so represents the child's addition to the author's thought. The imagination of children is very active, and they often add to a story in which they are interested.

Mispronunciations. These may be divided into two general classes. First, minor mispronunciations, which are of such a nature that the correct word can be recognized in the word as pronounced; and second, gross mispronunciations, in which no attempt is made at pronunciation or where the pronunciation is so poor that it becomes very evident that the reader has no knowledge of the work. Pronunciation under these circumstances may be merely a guess. The first type of error is due to many different causes. It may be caused by the wrong sounding of a letter or syllable; it is also true that environmental conditions make for errors in accent, and promote certain dialects. In other instances, the environment in which the child lives may account for such mistakes as "pore" for "poor." In a few cases mispronunciation may be due to speech defects. Many other mispronunciations are due to the child's lack of experience with language. He is constantly adding new words to his vocabulary, and it is to be expected that difficulties and confusion will arise in his mind. A type of mispronunciation which is due to an habitual lack of analysis of words is often found. The writer knows a well-educated man who never noted until a short time ago the difference between the two words "okra," a plant, and "ocher," an ingredient of paint. Such carelessness in dealing with simple words can be due only to habitual lack of analysis of words.

Substitutions. A consideration of substitutions shows at least two classes. First, there are those substitutions which are difficult to explain, where the word substituted does not make sense, and bears no relation to the remainder of the sentence. This type is found in poor reading, and as the child's reading improves, such mistakes are decreased. Certain children have difficulty with short words. A child known to the writer continually said "at" for "by," "on" for "in," etc. Such substitutions might be due to fluctuations of attention or to a subjective type of reading.

The second type of substitutions occurs when synonyms are used for the words in the texts. Such errors do not change the meaning in any great degree and indicate that the child is reading from memory or from the context.

The foregoing treatment of errors in oral reading must be considered as tentative, since it is based upon only a few cases. From the standpoint of diagnosis, it is very important that the psychology of the different types of errors be worked out in detail.

Results from Vocabulary Tests. Haggerty (10) has given median scores for the Thorndike visual vocabulary test, as shown in Table V. This table indicates a continuous increase

TABLE V

Showing Standards for Thorndike's Visual Vocabulary Tests, by Haggerty

GRADE	3	4	5	6	7	8
SCORE	4.0	5.26	6.00	6.66	7.29	7.91

through the grades. The increase for grade four is greater than that of any other grade. This is probably due to the fact that the progress of the pupil in reading up to this time has as its basis a knowledge of individual words. Later, his problems are much more of an interpretative character than in this earlier period.

This same author has shown also that there is a high correlation between the results of the visual vocabulary test and the test for the understanding of sentences in the third and fourth grades, but that the correlation is very small above the fourth grade. This probably means that in the early grades the child's reading depends upon his knowledge of individual words. While he is in these grades, he is still in the process of making his recognition of words automatic. When he reaches the later grades, this automatism has been acquired, and the reading is concerned with units larger than words.

Another factor which enters into the knowledge of words is the number of times that a child has come in contact with any single word. If a word functions in reading, it must at least be vaguely recognized. The number of repetitions required for ready recognition is a factor which varies from child to child and from word to word. Haggerty has pointed out that knowledge of words exists on three levels. They may be well known, barely known, or vaguely recognized. He gives also certain factors which determine the difficulty of words. These are as follows:

> Size of word, shape of word, mental content which attaches to the word, relation which a word bears to the speaking vocabulary of the child, relation to one's interests, lapse of time since the word was last seen, kind of type, and the place on the page where the child is accustomed to see the word.

QUALITY OF ORAL READING

But little progress has been made in the investigation of this phase of oral reading ability. A study made by the writer, in which children were graded upon such points as pitch of voice, poise, etc., shows that in very few cases can high grades be given. This may indicate that these elements are neglected in teaching. Teachers are interested in the correct pronunciation of words and in correct interpretation of thought, but not in the elements of the reading process indicated above.

Gray (4) reports that he has found a high correlation between quality of oral reading and rate. From this he concludes that it is not necessary to deal with quality. Though this may be true, problems for diagnosis still remain, because there are always individual pupils in whom the relation as pointed out by Gray does not exist. Diagnosis requires some definite plan for evaluating the factors which enter into the quality of oral reading. Some of these elements are emotional in character and others have a motor background. From this standpoint, the study of this phase of reading becomes highly important.

RATE AND COMPREHENSION

Since the methods for dealing with these two points are very similar, they may be considered together. If a body of data which bears upon either of these points is collected, it is usually put into the form of a distribution curve for study and consideration. Such a curve is seen in Diagram V. In dealing with a curve of this type, two factors must be kept in mind. The first of these is the norm of performance, and the second is the spread or range of ability.

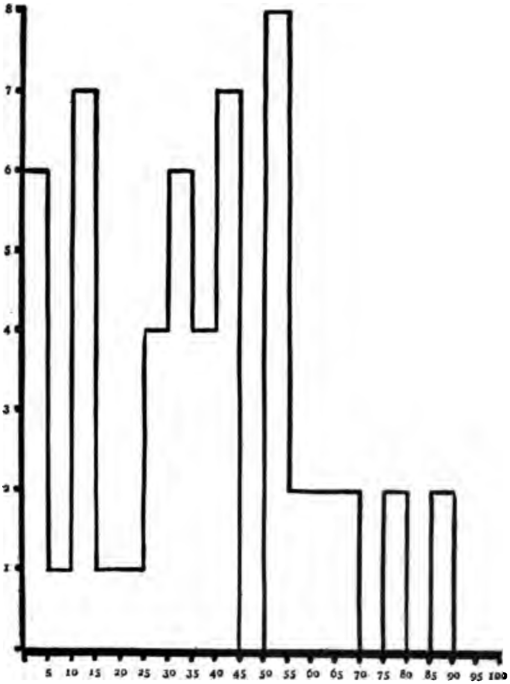
Norm of Performance. In reading work, this problem has usually been dealt with by determining the average or the median. As an illustration of this, Table III may be used. Such a table shows the variation of the norm for the different grades, and for the same grade taught under different conditions.

Many teachers have been confused in the consideration of the term "norm." Some have thought of it as the normal individual, while others have thought of it as the average individual. As a matter of fact, the method of calculating the median or average is such that in most cases there are no individual pupils who are represented by the units expressed in the average or median. It is much better to think of the norm as a measure of attainment. In this way it becomes the central attainment of a class or grade.

Uses of the Norm. Such data can be used by the superintendent or supervisor in comparing one system of schools with another, or one grade with another, or one teacher with another. No stronger argument can be brought before a body of teachers, in case it is desired to focus their attention upon reading as a subject, or upon certain phases of it which have been overemphasized or underemphasized. Many ideas or theories may be held in regard to the conditions which prevail in a system of schools; but if the concrete evidence can be presented, most of the opinions vanish, and the problem becomes one of interpreting the situation as shown by the data. Another use of the is that it gives to the teacher her aims in quantitative . Usually the aims of teaching are thought of qualita- or in the most general quantitative terms, such as pages

DIAGRAM V

ace of Frequency Representing the Distribution of Ability in Comprehen- This is an Example of a Very Unsatisfactory Condition. There are Five The Group is not a Compact One, as Regards Comprehension, wn



ıpters. The norm sets forth the work of a grade in ob- ɜ terms, and if tests are given from time to time it is pos- or the teacher to know how nearly her work is approaching m. Still another use of the standard is to be found in ɔsis. This function is the location of those pupils whose

TABLE VI

Showing Median Scores for Kelly Silent Reading Tests, by Kelly

GRADE		III	IV	V	VI	VII	VIII
First-class cities in Kansas	Median	4.3	8.8	13.1	13.8	16.1	19.7
	Number of Children	1873	2017	1819	1590	1546	1334
Second-class cities in Kansas	Median	5.9	9.7	14.3	14.3	17.3	20.6
	Number of Children	966	1067	994	1024	613	596
Third-class cities in Kansas	Median	4.6	8.2	11.8	12.5	14.0	20.6
	Number of Children	373	524	471	518	352	560
Kansas total	Median	4.9	9.0	13.4	13.7	16.1	20.1
Iowa total	Median	6.2	9.5	14.6	14.8	17.7	20.6
	Number of Children	2371	2940	2695	2597	2143	1819
Total from far-western cities	Median	6.1	10.6	14.4	15.0	18.0	20.6
	Number of Children	2282	2509	2643	2673	2508	2075
Thirty-five one-room schools in Kansas	Median	3.0	7.0	8.7	11.8	11.0	15.9
Cities in southern states	Median	4.7	8.4	12.3	11.8	15.4	19.2
	Number of Children	686	723	702	602	498	350

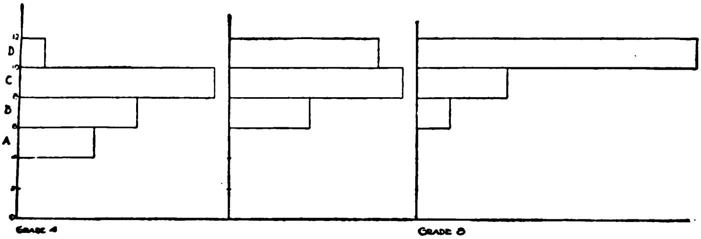
deficiencies are to be diagnosed. Seldom, if ever, will it be necessary to deal from this standpoint with children who are above or only slightly below the standard. Only those who are markedly below the norm need be considered. Experience has shown that the judgment of teachers cannot always be relied upon in the selection of pupils for this purpose.

Spread of Reading Ability. In dealing with a class of children it is always found that their ability has a certain range. The mean for the class may be satisfactory, but the problem of the individual pupil still exists. If a child stands so many units above the norm, it may be well to give him certain outside work to do in his reading preparation; while if another stood still higher, it might be best to promote him to the next grade. Again, certain other pupils who may be only slightly above the mean should be given the regular instructions of the class. The same type of problem may also be encountered with respect to the pupils below the norm, for there are those who should be sent back to the grade below, others who need individual attention, and still others for whom the regular instruction will be adequate. The superintendent encounters the same problem in dealing with different grades or schools as a whole. Before the measurement of reading ability is complete, there must be norms for variations in attainments as well as norms for degrees of attainments. Such norms have been established by Kelly (23) in terms of medians. When a considerable range is found in any class, there is a definite problem for the teacher and the supervisor. In certain cases, it may be necessary to re-grade the class; while in other instances, it may be necessary to give attention to the instruction.

Overlapping of Grades. The problem of the range of reading ability takes still another form. This may be spoken of as the overlapping of grades. This problem has been discussed at some length by Haggerty (11). Some of his results are shown in Diagram VI.

DIAGRAM VI

Understanding of Sentences. Showing Overlapping in Grades 4, 6, and 8 in One City, by Haggerty



This diagram shows results for the fourth, sixth, and eighth grades. These data indicate that, while the percentages vary from grade to grade, each grade has pupils in each group, except A, where only pupils of grade four appear. Haggerty discusses this from the standpoint of grading. His argument is that th pupils are poorly graded, and that certain ones should be promoted to a higher grade and others should be put back into lower grade. Such procedure may solve the problem for th bright child, and it may be that certain of the poor student need to go back and do more of the same type of work as the have done earlier; but it is altogether probable that certai others need to do a different type of work, which can be determined only after a careful study of their particular cases ha been made.

This problem has also been studied very carefully by Krus (19). This writer criticizes very severely the use of single test as a measure of overlapping. Some of his conclusions are give in the following quotations:

> Summarizing, we may say that the amount of overlapping measured by a single test is reduced appreciably when measured by a composite of a number of tests of the same trait, there being a direct relation between the number of tests entering into the composite and the amount of reduction Moreover, when a further grouping of scores is made by recombining thes composites of single tests in a given trait into a gross composite representative of ability in a more complex trait, as, for example, control of the vernacular as exemplified in our English composite of 22 tests, the amount o overlapping is appreciably reduced. Extending this grouping so as to include a composite of results from tests of a still different trait, such as arithmetic, we get still more reduction of the overlapping in this complex, more nearly representative of school ability.

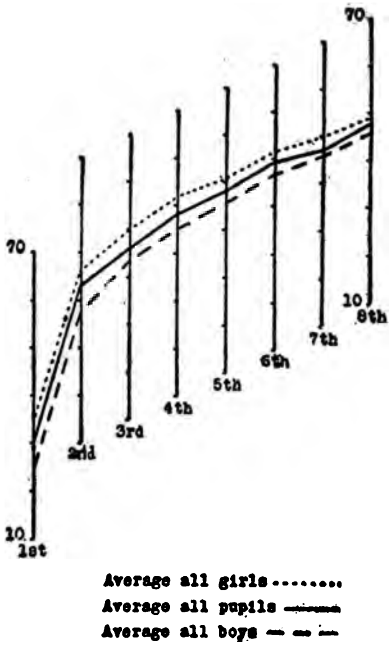
Kruse's discussion places the problem of the overlapping of grades in an entirely different light, and it is evident that Haggerty's results which were based upon single tests need to be scrutinized very carefully before they are used as a basis for procedure. However, it is difficult to see that Kruse's results shed any new light upon the problems of diagnosis, because, when his methods are used, the problem of the individual pupil yet remains.

Progress through Grades. Another form in which results for comprehension or rate may be arranged is shown in Diagram

VII, taken from Gray's (9) results. The vertical lines represent the different school grades, and the height of these lines indicates the scores made. Such curves show progress through the several school grades. Viewed from this standpoint very marked progress is to be noted from the first to the second grade and a very gradual increase from that point through the eighth grade. This curve has the form of most learning curves and corresponds to the results reported by most investigators in reading. Many of the discussions of the later chapters will have to do with the factors which determine advancement in reading.

Diagram VII

Showing Average Scores in Oral Reading for Girls and Boys in Each of the Eight Grades, by Gray



RELATIONS BETWEEN RATE AND COMPREHENSION

Another problem which has been investigated by means of tests is the relation which exists between rate and comprehension. The old idea was that the maxim, "slow and sure," should be heeded in teaching children to read. In discussing this point Judd (15) says that good readers are usually not slow and poor readers are usually not fast. Haggerty (11) may be quoted upon the same topic as follows:

> We now know perfectly well that rapid work may be more accurate than slow work, that many of the most accurate workers are the most rapid, that many of the slow ones are the most inaccurate, and that some are made more inaccurate by being slowed down, and that some are made more accurate by being speeded up.

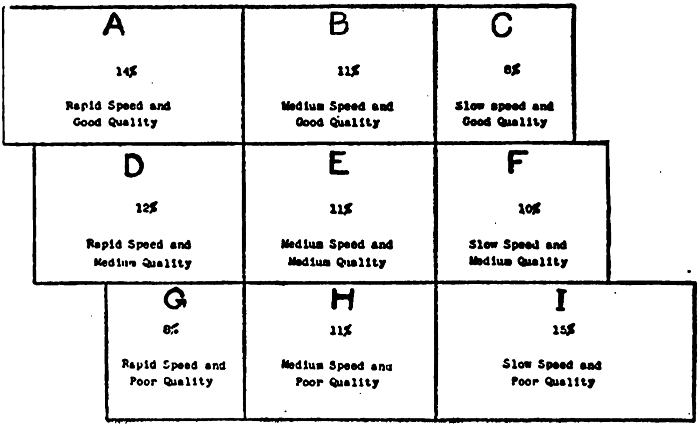
He explains this in terms of attention by saying that the most effective speed is that at which attention is least dispersed.

In dealing with the same problem, Gray (9) divided a number of children into various groups upon the basis of their records in his tests as to speed and quality. Diagram VIII presents nine degrees in which these two factors may be combined and shows the per cent in each group. In explaining the causes which give rise to such a situation, Gray emphasizes the fact that not sufficient time had been given to interpretation in the teaching of reading in the school system where these conditions prevailed. This is doubtless true, and if the instruction had been changed there would have been a shifting toward the upper groups. However, after such changes have been made there would still remain a certain number of pupils in each of the classes. To the teacher in charge, the same number and kinds of problems remain, and her success depends, in a degree, upon her ability to solve these various problems.

If the discussion of the results set forth in this diagram be carried further, it will be noticed that Group A is satisfactory from the standpoint of standards usually set by the school. However, if this group is considered as a superior group, then nethods for dealing with it become a problem. In Groups D and G, rapid speed is combined in the first case with medium quality, nd in the second case with poor quality. The fact that these upils read rapidly shows clearly that they are able to employ ertain factors which go to make up a high grade of reading bility, and leads to the conclusion that probably training has

DIAGRAM VIII

Showing Percentage of 1831 Cleveland Pupils Found in Each of Nine Groups in Speed and Quality in Silent Reading, by Gray



A	B	C
14%	11%	8%
Rapid Speed and Good Quality	Medium Speed and Good Quality	Slow speed and Good Quality

D	E	F
12%	11%	10%
Rapid Speed and Medium Quality	Medium Speed and Medium Quality	Slow Speed and Medium Quality

G	H	I
8%	11%	15%
Rapid Speed and Poor Quality	Medium Speed and Poor Quality	Slow Speed and Poor Quality

ailed to develop in the proper manner the other factors which nake for efficient reading. The same point may be made in egard to Groups B and C. Here those factors which make for omprehension are employed in an effective manner. It may e argued that if the factors which make for rate were better nderstood, training would increase the efficiency of the pupils n these groups. Again, the same argument will apply in a less legree to Groups F and H. Group E represents the average ndividual. Special drill may be of some help here. Group I epresents those pupils who lack native ability. The problem f diagnosis becomes, then, one of determining those factors which enter into rate and quality, and the teacher who deals with such a situation successfully must deal with it from this standpoint.

Other investigators have also been interested in the problem just discussed. King (18) has reported evidence from college students to show that there is little, if any, relation between speed and accuracy. He has worked out correlation coefficients to show that the relation is a negative one. His methods of measurement and the material which he uses are so different from those employed by Judd, Gray, and Haggerty that it is doubtful whether a comparison between the results of the different investigators is justified.

From the standpoint of diagnosis, many problems with respect to the relation which exists between rate and comprehension remain for consideration. Evidently, a complete explanation of a distribution as shown in Diagram VIII cannot be given in terms of instruction. Some of these difficulties are evidently individual matters and must be treated as such.

RELATIONS BETWEEN SILENT AND ORAL READING

Another important problem which has been revealed by testing is the relation which exists between oral and silent reading. The results of all investigators have shown that the rate in silent reading is greater than that in oral reading. This is due to the fact that the vocal movements required in oral reading are present in such a degree as to retard rate.

Pintner (25) has studied comprehension which follows both oral and silent reading in the fourth grade. His results show that fifteen children out of twenty-three do better in comprehension based upon silent reading than they do in comprehension based upon oral reading. Of the twenty-three children studied, six did better after the oral reading, and two did as well in one case as in the other. The average percentage of points in the interpretation for the whole class was greater for silent reading.

Mead (21) has studied the same problem with sixth-grade pupils. He finds that each class tested reproduced more points after the silent method of reading than after the oral method. Mead's results do not give data as to individuals, but it cannot be assumed that each child did better in silent than in oral reading. This leaves still the problem of determining why certain pupils continue to do better by oral methods, when for most children the silent method is more effective. Evidently, the two types of reading involved different methods of interpretation. The oral method is taught first, and certain children apparently are never able to change to the methods of silent reading.

Pintner and Gilliland (26) have extended the scope of Pintner's earlier study of fourth-grade children. This later study shows that college students and high school pupils read faster silently than orally. The other grades show no advantage for silent reading. The averages are so nearly equal that it may be said they read as fast by one method as by the other. In comprehension, there is little difference to be seen in the results. The children seem to do as well one way as the other. From these results, the authors conclude as follows:

> It does not seem to make much difference whether a child in the third grade reads aloud or silently. He gets about the same number of ideas per second either way. As we progress through the grades and up into college we find that it takes comparatively longer and longer for reading aloud and this increased time may result in an increase in the number of ideas reproduced. But this number of ideas gained is not nearly commensurate with the extra time expended. The silent reading of the adult is quicker than the oral reading and, at the same time, the number of ideas remembered is slightly greater, certainly much greater per unit of time. Thus it would appear that silent reading is, undoubtedly, the more economical besides being the method best adapted to the ordinary activities of life, since the vast majority of our reading is silent.

From the standpoint of diagnosis, the comparison of silent and oral reading ability in an individual pupil is an important matter. The two types of reading evidently involve different methods of interpretation, and an efficient reader must be able to change from one method to the other as occasion demands. Later chapters will reveal in more detail differences between the two types of reading, and the difficulties which attach to a transfer from one method to the other.

DIAGNOSIS OF READING ABILITY BASED UPON TESTS

Analysis. The treatment of tests, which has just been completed, shows the following elements in reading ability: (1) knowledge of words, both isolated and in context, (2) rate of reading, (3) quality of oral reading, (4) comprehension in silent reading.

These four elements will serve as a basis for diagnosis as proposed in this treatise. The general plan will be to collect data upon these different phases of reading ability by means of tests previously discussed. The norms which have already been determined will make it possible to tell the standing of any child upon all the phases of reading mentioned above, except the third.

In dealing with these elements of reading, investigators have used, in most cases, large numbers of subjects. Such work is necessarily lacking in detail and analytic study. Therefore, it is true that most of the problems brought to light cannot have fundamental explanations given for them. It is the purpose of the next three chapters to consider certain phases of reading ability which have been studied, for the most part, by means of laboratory methods. These methods are usually painstaking and detailed. Hence, they involve but few subjects. This allows the analysis of reading ability to be carried out in much more detail, and includes certain factors which are fundamental to the various phases of reading, as just discussed.

Tests to be Employed in Diagnosis. Another important element in diagnosis has to do with methods and means for measurement. The nature of reading is so complex that no single test will answer for any adequate or complete diagnosis. It becomes a matter, then, of selecting a series of tests from those which are available. In making such a selection, the investigator must bear in mind that no reading test has been devised especially for the purpose of diagnosis. In other subjects, certain tests have appeared which are designated as diagnostic tests; but, so far, this has not been true in reading.

For testing a knowledge of individual words, the Haggerty test for oral vocabulary or the Thorndike test for visual vocabulary may be used. To test ability to use words in context, Gray's oral reading scale seems best. This latter test offers opportunity for the study of errors and of rate.

No method for measuring the quality of oral reading has been standardized; hence any data which are collected upon this phase of reading will need to be obtained by means of observation.

The selection of a test for the measurement of the different phases of silent reading is a difficult matter. In fact, no single test will meet all the conditions. It seems that Monroe's test comes nearer fulfilling the requirements than any other. This test evaluates comprehension on different levels and gives a separate score for both rate and comprehension. It makes use of both the factual and puzzle types of questions and is very easy to administer. In addition to this test, it may be necessary, in some cases, to give a test based upon reproduction. If this is required, in order to make the diagnosis more complete, it will be found that Starch's test can be used to good advantage. Besides this, the diagnosis of a few children may require still other tests. Among these are skimming tests, speed tests, and direction tests.

To summarize, the tests to be used for diagnosis deal with the oral reading ability of children from only the standpoint of the pronunciation of words. Tests are provided for estimating the ability of the child in dealing with words both in isolation and in context. The ability of pupils to use words in context is considered both as to rate and as to the number and nature of errors. In silent reading, both rate and comprehension are emphasized. The latter element is dealt with from various standpoints and on various levels.

Interpretation. The last element of diagnosis is interpretation. The previous discussion of results has given a basis for this. Two points which are of very great importance in this connection are the relations which exist between rate and comprehension, and the differences which are to be found between oral and silent reading. A thorough understanding of these two problems is absolutely necessary if progress is to be made in interpretation. Later chapters will throw more light on this phase of the problem.

QUESTIONS AND EXERCISES

1. What elements in reading ability have not been measured thus far?

2. What suggestions can you give on the measurement of the quality of oral reading?

3. What elements and conditions in the giving of reading tests make for inaccuracies?

4. To what extent would you let the children know the results of a test given to their class? What advantage would be gained?

5. If you take the point of view that they should know the results, how would you present such material to them?

6. Is speed a constant quantity in silent reading for the same pupil, or will it vary with different types of material, as poetry, novel, scientific prose, etc.? What other conditions will make it vary?

7. Why should rapid reading be urged?

8. Would a knowledge of the extent of the vocabulary of the pupils in your class be of benefit to you? If so, how?

9. Would a compilation of tests which would allow a survey of the class at the beginning of the year, and so determine individual needs, be of service to you? How would you use such material?

10. What changes have taken place during the last ten years in the emphasis upon various problems in the teaching of reading?

11. What objections are there to requiring a certain minimum amount of material to be read by each child in a grade before promotion?

12. Make a list of five aims for instruction in reading in a particular school grade. To what extent are these aims quantitative and to what extent qualitative?

13. What differences do you notice in your classes with respect to vocabularies used by different children? Do these differences lead to differences in instruction? If not, why so?

14. Are there any aims in reading instruction which cannot be stated in quantitative terms? If so, make a list of such.

15. Make a list of one hundred errors in oral reading. Which type of error is most frequent? Classify the errors as to their causes. After this is done, how many out of the one hundred need serious consideration from the standpoint of remedial measures?

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B. THE ANALYSIS OF READING ABILITY FROM THE STANDPOINT OF VISUAL PERCEPTION

CHAPTER IV

QUANTITATIVE PHASES OF PERCEPTION

The term " perception " is used in this chapter in a restricted meaning. For our present purpose it designates the visual perception of the printed page.

However, after perception is limited in this manner it is still a highly complex process, and no less than thirteen problems, some of which have subsidiary points, have been attacked by different investigators. These may be enumerated under three general heads, as follows:

I. The Quantitative Phases of Perception
  A. Physiological elements
  B. Span of perception
  C. Unit of perception
  D. Variations in span of perception for different school grades
  E. The effect of arrangement upon the span of perception
  F. Relation of the span of perception to reading ability
  G. The effect of practice upon the span of perception
II. The Qualitative Phases of Perception
  A. Kinds of printing type
  B. Size of print
  C. Letters in their relation to perception
    1. Legibility of
    2. Form of
  D. Words in their relation to perception
  E. The length of lines in relation to perception
III. Methods of Perceiving Words

Each of the above problems is dual in its nature. First, it involves a physiological problem concerned with the stimulation of the retina of the eye by printed characters. Second, it comprises those mental operations which give meaning to these printed forms. The study of the first of these problems was undertaken early by physiologists. Out of these physiological studies there developed researches by psychologists upon the mental processes involved in perception.

The early work upon perception was not done from the standpoint of reading. The physiologists were interested only in the physiological problems of visual perception, and made no attempt to relate their results to reading ability. In the same way, the early psychologists were interested only in the general problems of perception, and were not concerned with perception as it relates to reading.

The first phase of the problem suggested in the title of this chapter is concerned with the work of some of the early physiologists. Plateau (32) observed that it requires a period of time for the complete formation of an impression produced by light. His problem was concerned with the length of time that is necessary for light to fall upon the retina in order that sight may take place. Later, Breucke (7) found this time to be .186 seconds. Exner (17) worked upon the same problem with elaborate and complicated apparatus. He showed that the time may vary from .119 to .287 seconds. He showed, further, that this decrease in time is subject to a law. The law which he enunciated is as follows: 'The length of the period of the stimulus decreases in an arithmetical series as the intensity of the light increases in geometrical progression."

Baxt (3) attacked the problem in a slightly different manner. He first exposed letters and curves, and soon afterward the retina was exposed to a bright light. He found that if the time between the exposures of the words and curves and the bright light was made short enough it was impossible to recognize the words. He then proceeded to determine the length of the period which would allow the recognition of the words and curves and took this as the time required for the perception of these objects. The observations recorded above are probably sufficient to show the nature of this type of work.

The relation of such results to reading ability has not been fully established. It is possible that one person may read more rapidly than another because of differences in these physiological processes, but such a relation has not been taken into consideration in accounting for variations in reading ability.

Other physiological problems which have been investigated recently involve the range of distinct vision and visual defects.

Range of Distinct Vision as it Relates to Perception. The question raised by this topic is whether there are any physiological limits to perception. If one perceives a short sentence at one time and a letter at another time, the sentence necessitates the stimulation of a larger proportion of the retina than is required in the case of a single letter. If it is possible for more material to be interpreted in a single act of perception than can be impressed upon the retina, then reading has a physiological limit. If this is true, a teacher should have some means of determining when such a limit is reached, for further training is useless.

The first investigator to deal directly with this problem was Ruediger (35). He used a short exposure apparatus, in which the exposure was made by a falling body. In his exposures he made use of two letters only. These were "u" and "n." In that part of the experiment which is of interest in this chapter, the letters were printed on cards, either to the right or to the left of a central point, thus:

· u
n ·

These distances varied from ten millimeters to forty millimeters. Ruediger concludes from these experiments that few, if any, readers use their full range of vision while they are reading.

Dockeray (13) was the next author to become interested in this problem. His method was much the same as that of Ruediger, except that he made use of all of the letters of the alphabet. He found that the span of distinct vision for letters in ten point type at a distance of thirty-five centimeters from the eyes is from twenty millimeters to twenty-two millimeters on either side of the fixation point. This means that all material interpreted in any reading act comes within the field of distinct vision.

The writer (22) investigated fourteen pupils in various school grades with respect to the same point. Some of these were good readers and others were poor readers. The methods used corresponded closely to those employed by Ruediger. It was impossible to see that the results of these experiments explained in any way the different abilities as found in the group.

Defects of Vision as Related to Perception. Though there are extreme types of defects, which seriously influence the reading activity, experiments have shown that minor defects have little or no effect upon it. The extreme defects are rather uncommon, and call for the services of a specialist. On the other hand, slight defects of vision are very common, but their effect upon reading ability is very slight. This should not be taken to mean that defects of vision are not to be corrected, because with proper glasses the child may be able to do the same amount of reading with a much less expenditure of energy. The point to be derived from these later physiological experiments is that reading ability is not limited either by the range of distinct vision or by slight defects in vision.

The Span of Perception. In a consideration of the mental phases of perception one of the important problems is concerned with the amount of material which may be comprehended in a single act of perception. In order to understand the term "span of perception" more thoroughly, it is well to think of perception as a process which goes on for a period of time. If one reads a page of printed material, there is no doubt that perception takes place. If the time required for reading the page be decreased until it is very short, the amount of material perceived is very small. Finally, the time may be made so short that perception cannot take place and, as a result, nothing is perceived.

The problem indicated in the chapter heading, then, is concerned with the amount of material which can be perceived in a single act of perception. In the approach to this problem, it is necessary that the time be very much reduced, because otherwise there is opportunity for a succession of perceptive acts rather than a single one. It is the single act of perception which *is of interest* at this time.

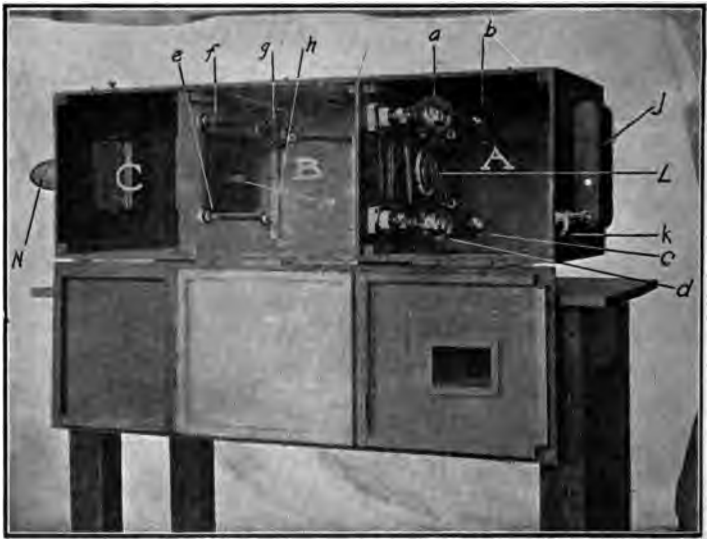

FIG. 1

Showing One Form of the Tachistoscope

A B C compartments
a b c d large lights
e f g h small lights
J container for reading material
k crank
L lens and shutter
M ground glass
N visor

This problem is most often attacked by means of the tachistoscope, or short-exposure apparatus. This is used to control the conditions under which perception takes place. It was invented by Helmholtz (26) about 1870, and since that time many forms have been used. One form of the short-exposure apparatus as seen in Figure 1[1] is here briefly described. It consists of three chambers, *A*, *B*, and *C*. Chamber *A* has in it four lights, *a*, *b*, *c*, *d*, which illuminate the material to be exposed. This material is printed on a long strip of paper which is mounted in the box at *J*, as a film would be placed in a camera. By turning the crank at *k*, the investigator brings into place at an opening in the front of the box the material to be exposed. The lens *L* focuses this material on the ground glass *M*, when the shutter in which the lens is mounted is open. The chamber *B* is lighted by four small lights, *e*, *f*, *g*, and *h*, while the chamber *C* is dark at all times. The subject makes his observation through the visor at *N*. If the shutter at *L* is open, he sees the material at *M*. If the shutter is closed, he sees the blank ground glass, illuminated by the four small lights. The shutter operates a switch which cuts off the small lights when the shutter is open and allows them to come on again when the shutter closes. The advantage which may be urged for this form of apparatus is that there are no moving parts to distract the subject and that the noise of the parts is reduced to a minimum.

With such apparatus, it is possible to expose at *M* many different types of material, such as dots, letters, words, etc. With the different time adjustments upon the shutter at *L* such material may be exposed upon the ground glass *M* for a fraction of a second or for a longer time. If this apparatus is understood, it is possible to state the problem at hand more definitely, as follows: If a series of letters such as C X M R is exposed at *M* for a fraction of a second, how many letters will be perceived? In other words, what is the spread or range of perception under such conditions?

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[1] This form of apparatus may be had from C. H. Stoelting Co., Chicago.

The first psychologist to procure data upon the problem wa Cattell(9). The particular problem in which he was intereste was reaction time, and the contributions which he made to perception were, in a way, by-products of his main experiments. His researches were begun in America, but were later transferred to Wundt's Laboratory in Leipzig. After his return to America his work was continued, and several articles were published upon various phases of the problem.

The purpose of the reaction experiment is to determine the interval of time between a stimulus and its response. For example, the time which elapses between the sight of a word and the speaking of it may be found; or the length of time required for the making of a simple movement, like tapping with the finger, after hearing a sound, may be determined. Such periods of time are spoken of as reaction times. Reading may be thought of as a series of reactions, and the rate of reading will depend, in a measure, upon reaction time.

Since such periods of time are very short, it requires accurate apparatus with which to perform the experiment. The unit of time which is usually employed is .001 of a second. By means of such apparatus, Cattell found that, in order for a letter or a word to be read, the light reflected from it must work on the retina from .001 to .017 seconds. The time for a word was found to be slightly shorter than for a letter. He also emphasized the fact that it took no longer to apperceive a phrase and, in some cases, a short sentence than it did to interpret a single word.

From these experiments of Cattell's, it is clear that perception has a spread, a range or a span. Such a range is dependent upon different factors to be discussed later, and varies with different conditions. The fact that such a range exists makes reading, as it is usually carried on, a possibility. The difficulty which one may encounter in deciphering the letters in large advertisements illustrates the point at hand. In reading these the observer may have to interpret each letter in the series by tracing it out with the eye. This is a slow and tedious process, because the conditions are such as to reduce the span of perception to a part of a letter. If this same method were required in all reading it would be a very different process from that employed by most readers. If the interpretative processes of reading proceed rapidly and easily, they do so because the material is perceived in units larger than would be possible in the case of the advertisement just mentioned. The span of perception, then, is a highly important factor in the reading process. Most languages when printed require a span of perception from left to right. In Japanese, there is an example of language which makes use of a span in a vertical direction. It seems most probable that printing might be done in a manner so that a span both in horizontal and vertical directions could be utilized. If pages were printed in small blocks rather than in lines, the perceptive process could operate in both directions. Indeed, even with the present form of printing, an experienced reader may, if the material is familiar, get some meaning from the lines below the point where the reading is actually being done. One type of reading which always proceeds in two dimensions is used in the perception of the musical characters which serve as a means for directing the fingers in piano playing.

The Unit of Perception. From his experiments Cattell concluded that the unit of perception is not the letter, but that it may be a word, phrase, or a short sentence. He found also that very short exposures, which would allow only the recognition of a letter, were of sufficient length to allow the recognition of short words.

He emphasized, further, that the time in which a short word may be apperceived is not sufficient for the recognition of a single letter. This is probably due to the fact that the word has meaning while the letter has little or none. In contrast to this Messmer (30) found the time required for the recognition of letters in the reading of beginners to be shorter generally than the time required for the recognition of words. Perhaps the children had been taught their letters before words. As a result, they were more familiar with letters than with words at the time at which Messmer conducted his experiments with them.

The unit of perception varies under different conditions. The most favorable conditions for the use of a long span of attention in reading are probably a knowledge of the topic at hand and an experience which makes for an understanding of the thought of the selection being read. This indicates that children should do much reading in material which fits into their experiences and which is readily interpreted. Such reading will do much to enhance the proper use of the range of perception and other important elements of the reading habit. It is not to be forgotten that the child must also deal with material which presents difficulties to him. Such material necessarily involves analysis of both content and form, and makes for small units of perception. However if this type of material is used continuously, it may develop reading habits which result in inefficiency. Resourceful teachers will make use of both types of material.

Again, the unit of perception may depend upon maturity. Cattell's work was done with adults; so it cannot be argued that his results apply directly to children in their early years. In oral language children go through a period in which they deal almost entirely with words. It may properly be argued that the same tendency is characteristic of the early stages of children's reading.

The conclusions of Cattell have been confirmed by other investigators. They were, however, opposed by Zeitler (41) and by Goldscheider and Müller (21). These authors contended that the reading stimulus is not the entire word, but rather certain parts of it which give it its individuality. Zeitler speaks of these parts as "dominating complexes," while Goldscheider and Müller speak of them as "determining letters." These theories have never been given general acceptance and have had but little influence upon the teaching of reading. On the other hand, Cattell's theory has had wide acceptance and has had great influence in establishing and fixing the methods of teaching primary reading.

The view held by Cattell makes perception a synthetic process rather than one of analysis. The early teacher of reading proceeded upon the theory that words must be spelled or analyzed before reading could take place. The acceptance of the word and sentence methods, which were based in a large degree upon Cattell's results, led for a time to the other extreme. In such procedure the child was given no means of analysis, and, as a result, when he came to a new situation he had no methods for extracting himself from such difficulties. It was soon realized that some method of analysis was necessary for the child, and the problem has been solved, at least in part, by teaching him to spell in connection with his reading and by giving him the technique of phonics.

These two processes, synthesis and analysis, stand opposed to each other, and the difficulty lies in so balancing them that the one does not overshadow the other. Both processes must be taught and both must be held clearly in the mind of the teacher.

The Length of the Span of Perception for the Different School Grades. If the span of perception has an important place in the reading activity, then its development through the different school grades should be understood. Some data upon this problem have been compiled by the writer (22). The short-exposure apparatus used in the experiments was similar to that previously described. The material was in the form of short sentences containing two, three, four, five, and six words. A part of the subjects took a seven-word series. Three sentences of each type were given. Table VII shows results for this work.

A comparison of the results for the third grade and the college group shows that there is a decided increase from the first to the last. This increase does not appear to be continuous through the grades. From the third to the fourth grades an increase is apparent, but through the fifth and sixth grades, the results are more or less erratic. After this, the increase is continuous. The erratic condition during the fifth and sixth grades probably represents some change in methods of reading. It is possible that reading in the early grades, which is done with a short span of perception, requires a distinct method of interpretation. Such a method must be slow and tedious, and, as the span of perception increases, this method changes into one which is more effective. The erratic results shown in the above table may be due to a shifting from one method to the other. In some parts of the experiment, the material exposed was such that the method which involves a long span of perception gave effectual results, while in other parts the material was of such a nature that there had to be a reversion to the method involving a short span. As a result, the success of the child is not so great as when he is able to use the method involving the long span. This change is similar to one from the processes involved in reading the large advertisements, already mentioned, to the methods used by the experienced person in ordinary reading. A change from one method to the other could easily produce erratic results, such as those found in the preceding table.

TABLE VII

Showing Increase of Perceptual Span Through the Various School Grades

GRADE	AV. 2 WORDS	AV. 3 WORDS	AV. 4 WORDS	AV. 5 WORDS	AV. 6 WORDS	AV. 7 WORDS
3	1.7	1.8	1.9	2.0	2.4	2.2
4	1.8	2.3	2.7	2.8	3.1	
5	1.8	2.0	2.0	2.7	3.0	
6	1.8	2.2	2.1	2.3	3.0	
7	1.8	2.2	2.5	2.9	3.4	2.4
H. S.	1.8	2.6	2.8	3.8	3.9	3.1
C	2.0	2.6	3.5	4.2	4.2	2.8

The total increase through the grades is doubtless due to training, experience, and familiarity with language forms. Each of these factors will be discussed later. It is also possible that mental and physical maturity plays its part in the increase of the span of perception.

Another point concerning Table VII is the decrease of the span for the seven-word series. In most cases there is an increase in the span from the two-word series to the six-word series. This is due in part to the fact that a six-word series offers greater opportunity to the reader than does a two-word series. In many cases the subject is able to avail himself of such an opportunity; but when he is confronted with a seven-word sentence, confusion results. Some of Cattell's (10) data relate to this point. He reports that of nine persons studied in one of his experiments four could read letters faster when five letters were exposed at a time. This same group was not helped by a sixth letter. Others did best when four letters were exposed, but were not helped by a fifth letter; and still others were not helped by a fourth letter. In the same connection, Gates (20) has shown that if digits are exposed in numbers which exceed the span of perception, the number of digits that can be recalled is decreased. These experiments suggest that material for beginners should be carefully selected as to its complexity. Sentences that are too long and too involved cause confusion on the part of the child and may finally result in habits which are not desirable. Doubtless words also present to children difficulties as to complexity. Bowden (6) found that words of five letters gave more difficulty than did words of a fewer or a greater number of letters.

Griffing (23) has attacked the problem of the span of perception for different school grades from the standpoint of both age and grade. In his experiments, a short-exposure apparatus was used. The material exposed was in the form of nonsense syllables. Six letters were exposed each time. In addition to the above technique, this investigator added one other element to his experiment. When everything was ready for the experiment the subject was told to look at a certain fixation point on the apparatus until the material appeared. The time during which the subject was required to fixate his attention was varied and results were obtained for each variation. The average of the total number of letters seen correctly by the various school grades is as follows: First grade 2, second and third grades (combined in one group) 6, fourth grade 7, fifth grade 14, sixth grade 12, seventh grade 14, eighth grade 21, high school 23, and college 29.

In his discussion, Griffing says:

> It is evident that the extensive threshold of ability to receive and retain a number of simultaneous impressions is a function of individual growth, reaching its maximum only when the observer is fully developed.

It seems that this author has in his results an erratic condition through the fifth, sixth, and seventh grades. This is similar to the conditions found in the preceding study. In one of his discussions, Messmer (30) emphasizes that children pass through a period of fluctuating attention. Such a period of fluctuation would probably produce erratic results, such as those found in each of the previously cited studies.

From the preceding results, it is clear that there is an increase in the span of perception through the various school grades. This seems to be due to both maturity and practice. Such an increase in the span of perception may produce an entire change in the methods employed by the child in his reading. Some pupils are able to make the transition from one method to the other without difficulty, while others show very clearly that they are unable to change from the use of a short span to the use of a longer span, without considerable confusion in their mental activity.

The Relation of Context to the Span of Perception. The foregoing experiments may be criticized in that they set up conditions which resemble the beginning of the reading process, rather than that process after it has proceeded for a period of time. Such criticism is of importance because the reading in the middle of a portion of a selection may be a different process from the reading at the very beginning.

Quantz (33) first attacked this problem in the oral reading of adults. While his subjects were reading, this investigator placed a card over the reading matter at some predetermined point, which was unknown to the reader. After the card was in place, the reader continued reading as far as possible. Records were made for that part of the reading which came after the card was in place. Quantz selected three different positions in the reading matter for placing the card over the selection. These were the beginning of a line, the end of a line, and the middle of a line. By such technique, it is possible to determine how far the attention runs ahead of the voice in oral reading. This span was called by Quantz the "voice-eye" span. He found the average span for the beginning of a line to be 7.4 words, for the middle of the line 5.1 words, and for the end of the line 3.8 words. These results are greater than the results for adults in Table VII. Such a difference is due in part to the effect of context. Another factor which must operate to produce this difference is that the voice proceeds slowly while the attention has no such restrictions. Quantz also emphasized that there is a close relation between such a span and rate of reading. He thought that there must be a considerable distance between the eye and voice if the reading is to be intelligent. This distance apparently allows a partial interpretation; and when the visual and motor phases become sufficiently definite, the full meaning attaches to the experience.

The writer (22) has studied the problem by still another method. Figure 2 gives a sketch of the apparatus used. The reading material in the form of a lantern-slide was placed in the lantern at *X*. When the photographic shutter at *H* in which the lens of the lantern is mounted is open, the reading selection is reflected from the mirror *B* to the surface *C* and can be read by the reader from *D*. When the shutter is closed nothing appears at *C;* or when the material is exposed and the shutter is made to close, the reading material disappears suddenly from the view of the reader. The surface at *C*, then, may be a blank or it may have reflected upon it a reading selection, depending upon whether the shutter at *H* is open or closed. By closing the shutter, the investigator may cause the reading material to disappear from the view of the reader at any point in the selection that may be chosen by the operator. The material used in the experiment consisted of eight selections, which varied in difficulty.

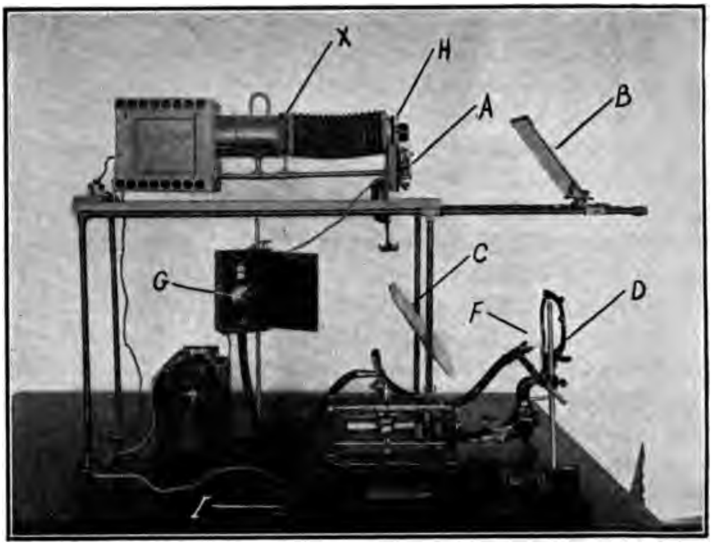


FIG. 2

Showing Form of Apparatus Used in Determining the Voice-Eye Span

A magnet
B mirror
C reading surface
D headrest
E speaking tube
G bell
H shutter
I electric key
X reading material

The subject read into the speaking tube *F*, and his voice was recorded upon the wax cylinder of a dictaphone. When the key *I* was closed to operate the electric magnet *A* which closed the shutter at *H*, a second magnet operated the bell at *G*. The instant the material disappeared from the view of the reader, the sound of the bell was recorded upon the cylinder. The subject continued reading as far as possible after the material disappeared.

By this means, the total reading of the individual was recorded upon the cylinder. The operator then listened to the record as reproduced from the wax cylinder and that portion of the reading which came after the sound of the bell represented the voice-eye span, or the range of recognition. In this way, data were collected for the range at the beginning of the line, the middle of the line, and at the end of the line. These results are shown in Table VIII.

TABLE VIII

Showing Average Voice-Eye Span for Successive School Grades

GRADE	Average No. of Correct Words to the Line			
	Beginning	Middle	End	Average
3	3.3	2.7	2.9	2.9
4	2.9	2.4	2.1	2.5
5	3.3	2.7	2.6	2.8
6	4.0	3.1	3.2	3.4
7	4.3	3.6	3.6	3.8
H. S.	4.6	4.5	4.4	4.5
C.	4.8	4.4	4.2	4.4

This table gives the average range for successive grades. The results show that the fourth and fifth grades do not have a span which exceeds that of the third grade. From the fifth grade there is an increase in the range through the various grades until the college group is reached. Here the results for the middle of the line and the end of the line are not so great as the same results for the high-school group. The smaller range for the fourth and fifth grades may be due to the fact that the children are in a transition period in the development of their reading ability. The fourth and fifth grades are probably stages in school life when the child changes his mode of reading. If he is called upon to read aloud at this period, his attention may be distracted, so that he is less efficient than he would be at either an earlier or a later stage. The very small difference between the high-school pupils and the college group indicates that those in high-school have about reached the limit in such development, and the differences between the groups may be thought of as individual differences. With the exception of grades four and five, the averages shown in Table VIII are greater than the results for the six-word series in Table VII, where the short-exposure experiment was used. Such a comparison of the results gives additional evidence of the transition period which evidently comes in development of reading ability.

It is also of interest to compare the results of the voice-eye span with those of the short exposure experiment already described. In the case of a single individual each span may be long or each may be short, or one may be short and the other long. The results for the voice-eye span experiment should indicate a greater span than the results in the short-exposure experiment, because in oral reading the reading process is retarded by the vocal movements, while the attention has no such restriction placed upon it. Hence, there will be a considerable distance between the focus and the margin of the perceptual field. In silent reading, the vocal movements do not enter, in any great degree, and, as a result, the focus and margin are more nearly coincident. It is also true that in the voice-eye experiment, the reader has the benefit of the context in a greater degree than in the short-exposure experiment. Hence, it would seem that, if there is no great disparity between the results of the two experiments, the reader is using a method of interpretation which is in harmony with his perceptual ability; but if there is a difference, then the reader is possibly not well adjusted in his method of reading. Table IX gives data for the comparisons as suggested.

TABLE IX

Showing Relations between Span of Perception and Rate of Reading

Subjects	Av. on 6 word series (short exposure)	Av. no. of correct words for middle of line. Voice-eye span	Range in oral rate	Range in silent rate
(1)	0.5	1.0	2.5–0.8	3.1–1.3
(2)	4.2	1.8	3.1–0.6	2.9–1.2
(3)	2.8	6.2	4.8–1.8	3.9–2.6

Results are shown for three pupils. The second column at the left gives results for the six-word series mentioned in the short-exposure experiments above. Column three gives results for the same pupils in the voice-eye experiment. Column four gives the range in rate for the same readers in reading orally a series of passages of varying difficulty. The silent-reading rates were also obtained by having the same subjects read a series of passages of varying difficulty.

In the results for the first subject, there is a correspondence all the way through. There is a short span of perception in each of the perception experiments and a slow rate in both oral and silent reading. The data for subject two show entirely different conditions. In the short-exposure experiment the record of 4.2 is above the average, while in the voice-eye experiment, which is taken from actual reading, the result is 1.8, which is very low. The rates are both slow. This can indicate only that this pupil has a span of perception above the average, but that he is not able to employ it to its full extent in his reading. Interpretation for a single act of perception is done in an efficient manner; but when the acts of perception follow each other in rapid succession, as in reading, interpretation becomes very slow and tedious. Such conditions would evidently be remedied by having the child read material in which he was interested, and which was within his grasp, so that there would be little or no difficulty in interpretation.

The results for subject three are very different from those of the preceding case. Here the data for the short-exposure experiment indicate such a short span of perception that results in the voice-eye span experiment might be expected to correspond very closely to them. This does not prove to be the case, however, for he has a span for the second experiment which is equal to that of the average span, or better. This reader does better in rate of reading than either one of the two pupils above. One interpretation which may be placed upon such conditions is that this subject is erratic in his mental operations. He has the ability to do efficient reading, if he chooses, but, unfortunately, he is willing to do much of his work upon a low level of attention. If such a view is accepted, it is rather difficult to give reasons why the pupil is stimulated to greater activity at certain times than at others.

In the case of subject three, the best results are obtained again where oral reading is involved. This may mean that this reader is more efficient when he uses the methods of interpretation involved in oral reading than when he uses the methods of silent reading. The fact that oral reading proceeds slowly may have enabled this pupil to be more efficient under the conditions of this type of reading.

The results which have been pointed out in connection with Table IX indicate that some other factor than the span of perception operates to determine reading ability. In other words, a wide span of perception is not sufficient within itself to give efficient reading ability.

Data of the same sort as in the voice-eye experiment may be procured from silent reading by the method of introspection. By the use of the apparatus previously described, the reading matter may be made to disappear just as before. If the subject reads silently, and notes the word where his attention was focused when the material disappeared, and then records whatever he remembers of the material after that particular word, the extent of the span of perception in silent reading is obtained. This process depends entirely upon introspection, and, for this

TABLE X

Showing Range of Recognition in Silent Reading for Adults

Subject	Average no. of words per line	Subject	Average no. of words per line
1	3.1	5	2.5
2	3.9	6	3.1
3	2.7	7	2.7
4	1.1	8	2.0

reason, the results are valid only for adults. Table X gives results for eight adults. Each subject read eight selections of varying difficulty and made one report on each. The average of words given in the table refers to the average for these eight reports. In general, averages for this span of perception are smaller than in similar experiments for oral reading. This is due to the fact that silent reading is not retarded by vocal movements. The very large variations which are found in the results of this test must be closely related to differences in rate which were found in the same group.

Another method used by the writer (22) in studying the eye-voice span made use of apparatus which allowed phonograph records of oral reading and eye-movement of the same reading to be synchronized.

This work showed large individual differences and much variation in the span of the same individual from time to time.

Buswell (8) has used a variation of this method in an extended investigation. Some of his most important conclusions are as follows: (1) a positive correlation was shown between a wide eye-span and mature reading habits; (2) width of voice-eye span has a positive correlation with rate of reading; (3) a negative correlation is shown between width of voice-eye span and number of fixations per line; (4) the development of the voice-eye span does not show a consistent increase from grade to grade, but is very irregular; (5) little correlation was found between width of voice-eye span and position in the line; (6) a marked correlation exists between width of the voice-eye span and position in the sentence; (7) the voice-eye span is very elastic.

Huey (27) studied the problem of the relation of context to the span of perception from the standpoint of silent reading. His method consisted in reading a selection to his subjects up to a certain point and then exposing the next word, or words, by means of a short-exposure apparatus. The amount of material exposed was varied, and results were obtained for the different amounts. This plan allows perception by means of the context after the reading process is well under way, although the pause between the reading and the short-exposure experiments must have been distracting. The results are given in millimeters instead of words and so cannot be compared with the results of other investigators. The total extent of material in millimeters for four subjects is 21.7, 8.8, 23.9, and 27.8. Huey does not make any attempt to relate these results to reading rate. Their chief value lies in pointing out that large individual differences exist.

Hamilton (25) has attacked the same problem by a method similar to that employed by Huey. His experiments were carried out by means of a short-exposure apparatus. His method differed from Huey's in that all the material was exposed in sections from left to right. Three types of selections were used: paragraphs, miscellaneous phrases, and miscellaneous words. These were all read by successive exposures in such a way as to render the procedure very similar to the successive reading pauses in normal reading. The results of this experiment for one subject are shown in Table XI. This subject is able to read more by this method when phrases are exposed rather than words, and a still greater amount can be read when the paragraph is exposed.

Table XI

Showing Amount Read Correctly in Millimeters for Successive Short Exposures, by Hamilton

Subj.	Sel.	Rate	Paragraphs		Phrases		Words	
			M	M. V.	M	M. V.	M	M. V.
W	1	.044	34.3	10.5	30.4	8.7	20.4	9.1
	3	.013	31.6	7.2	30.2	9.0	22.1	7.2
	5	.007	31.4	9.0	25.2	8.4	19.2	7.0

Explanation of abbreviations and terms: *Subj.* Subject; *Sel.* Selection of reading matter; *Rate.* Time of exposure in seconds; *M.* Average amount in millimeters read per exposure; *M. V.* The mean variation from the average of amounts read per exposure.

The preceding experiments have shown clearly the close relation of context to the span of perception. In most cases the span is increased when context is involved. This argues that training in reading which employs isolated and disconnected words makes for a short range of perception; while if a child is allowed contact with material which is within his grasp, there is opportunity for the development of the wider span of perception. The influence of context evidently comes through two different avenues. First, it is of aid to a reader who has a knowledge of language relations and a feeling for them, and, second, it aids very materially those persons who are able to avail themselves of marginal impressions in their reading. A detailed discussion of each of these factors will be given in another connection.

The relation of the span of perception to the reading process has been little understood by teachers, and few have been made to take it into consideration in the methods employed in teaching the subject. Careful teachers may be able to pick out pupils who have difficulty in changing from interpretation depending upon short units to interpretation depending upon larger units. Such teachers should attempt to devise methods for dealing with such cases.

The Effect of Arrangement upon Perception. Another factor which determines in a large degree the extent of the span of perception is the way in which material is grouped. In the short-exposure experiment it is possible to change the span of perception very materially by the rearrangement of material. If the group of letters, "Themanwenthome" is exposed, probably only three or four letters will be recognized. But if the letters are written "The man went home," the entire group may be perceived. Goldscheider and Müller (21) found that, if straight lines were arranged in a haphazard order, as shown under A in Figure 3, and were exposed for a very short time, the most that could be perceived was four or five lines; but, if the same type of lines were arranged in some symmetrical manner, as shown in *B* of Figure 3, the number of lines which could be perceived was very much increased. Freeman (19) has investigated the same problem as it relates to number of ideas and finds that the same law holds. If dots are exposed thus ······ and then the same number is exposed in another form, as : : : the number which can be perceived in the second arrangement is very much increased.

The general point which is of interest to teachers at this time is that reading may be thought of as the interpretation of grouped stimuli. Printed language as involved in reading is a grouping of letters and of words. In the groups of lines or dots above, the advantage of one grouping over another lies in the fact that one form lends itself to interpretation in a manner which is not true of the other. In dealing with words, the investigator will find that the form may play its part, but their meaning is also an essential factor in the experiment. The relation of meaning to reading efficiency has been dealt with by Hamilton (25). His experiments were performed by means of a short-exposure apparatus. The material exposed consisted of short sentences, phrases, and words. Some typical results are shown in Table XII. This table shows that material which involves meaning in the greatest degree (sentences) makes for the greatest efficiency in reading, while material which has meaning in the least degree (words) makes for the least efficiency.

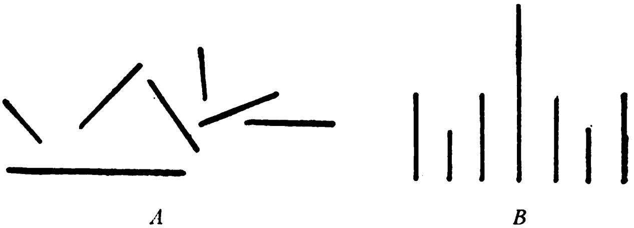


FIG. 3

Showing Different Arrangements of Material for Short-exposure Experiment

The problem of the teacher of reading is to provide methods and means by which the child may become thoroughly familiar with the groups or combinations found in printed language.

Such experiments as Hamilton's indicate the large value of connected material in developing such a program.

TABLE XII

Showing Amount in Millimeters, of Words Arranged in Sentences, Miscellaneous Phrases, Miscellaneous Words, Read at a Single Exposure of .021 Second, by Hamilton

Subject	Sentences		Phrases		Words	
	M.	M. V.	M.	M. V.	M.	M. V.
A.	41.6	10.3	34.5	10.5	12.9	6.6
M.	23.6	11.1	17.6	8.0	13.1	5.8
W.	33.1	10.7	27.7	10.1	16.3	7.1
B.	25.4	7.8	23.4	4.1	13.1	6.5
C.	42.8	6.6	34.9	10.4	23.6	12.3

M. Average; *M. V.* Average variation

There must be no confusion and no hesitation in the recognition of the various words or groupings. For a large majority of words, it is possible for the pupil to reach this level of automatism, but a few words may remain in the vocabulary of most pupils for which they do not acquire this high degree of automatism. To illustrate, the writer is always conscious of a "second look" at any one of the three words, "philosophy," "physiology," and "psychology." The recognition of these words is not so automatic as that of many other words in his vocabulary.

The effect of automatism upon recognition is also of interest at this time. At first, it may be necessary to look carefully at a word before recognition takes place, but later, certain characteristics of the word stand out and these outstanding features seem sufficient for recognition. Before the perception of a word is thoroughly automatic, the element of guessing may enter into its recognition. Sometimes such guessing leads to the wrong word, and in the interest of correct interpretation the mistake must be righted. Many of the mistakes of children can be accounted for because the child is in the process of making the recognition of a word automatic. In order to save time, he resorts to guessing, and this leads him astray. This may be a partial explanation of the erratic condition of the fifth and sixth grades found in Table VI.

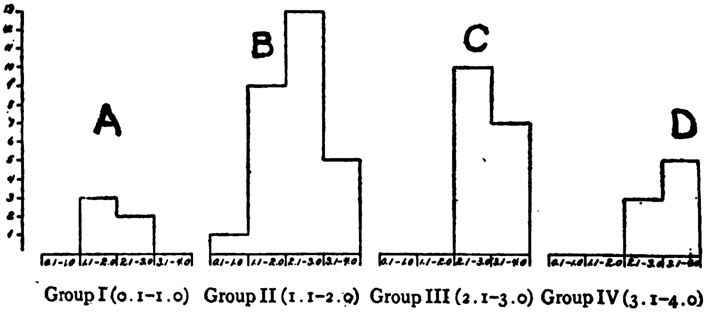
In many cases, such automatism can be attained as a result of synthetic processes. This means that proficiency is gained by learning the form as a whole. In other cases, such automatism will result only from a process of analysis. Whatever the method involved, it is necessary that there be automatism in the perception of words if efficiency in reading is to be gained.

There is also a hierarchy of automatic habits. Not only do we learn to recognize words, but we learn to recognize, in the same way, phrases and other larger language units. These higher levels of automatism result in anticipatory feelings for what is to come in a selection. These may be spoken of as feelings for language relations.

Relation of Span of Perception to Rate of Reading. Data given by the short-exposure experiment are sometimes objected to on

DIAGRAM IX

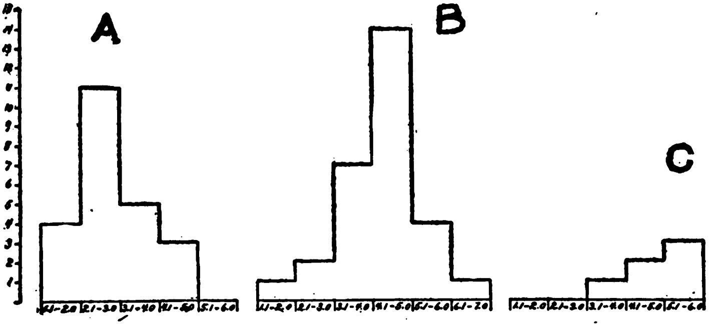
Showing Relation between Span of Perception and Rate of Reading



the ground that the mental activity involved in the experiment is not reading. That there is a close relation between such results and the rate of reading is shown in Diagram IX. In compiling these data the writer arranged the subjects in four groups upon the basis of the minimum rates at which they read a series of passages of varying difficulty. In Group I were placed all those whose rate of reading was from one tenth of a word to one word per second. In Group II were placed all those whose reading rate was from one and one tenth words to two words per second; and so on, for Groups III and IV. The subjects in Group I were then distributed in Curve *A;* those in Group II were distributed in Curve *B;* and those in the remaining groups were arranged in a similar manner. The base line of these curves represents the span of perception. A survey of these data shows that the greater part of those in Group I, as indicated by the height of the rectangles, had a span of perception which ranged from 1.1 to 2.0 words, while in Groups II the greatest number of subjects had a span of perception of 2.1 and 3.0 words; and so on, for each of the groups. Thus it is seen that, as the span of perception increases, the rate of reading increases.

Diagram X

Showing Relation between Voice-Eye Span (Beginning of a Line) and Rate of Reading



Group I (0.1-1.0) Group II (1.1-2.0) Group III (2.1-3.0)

In the same way, data from the voice-eye experiment may be arranged as shown in Diagram X. Groups I, II, and III are arranged upon the same basis as indicated in Diagram IX. The digits in the base line indicate the span of perception. The height of the rectangles indicates the number of subjects. It will be seen that the greater part of those in Group I, as indicated by the height of the rectangle, has a span of perception which ranges from 2.1 to 3.0 words. In Group II the greatest number has a span of perception which ranges from 4.1 to 5.0 words; and in curve *C*, the greatest number has a span of 5.1 to 6.0 words. Again, the rate of reading increases as the span of perception increases.

Correlations which exist between the span of perception and rate and comprehension in reading have been determined by Starch (38). Such correlations are found in Table XIII. The results as shown in this table serve to emphasize the relations which were shown in the diagrams just mentioned.

TABLE XIII

Showing Correlation between the Perceptual Span and Speed and Comprehension in Reading, by Starch

	Speed	Comprehension	Speed plus comprehension
1. Visual perceptual span-letters	.40	.32	.41
2. Visual perceptual span-unrelated words	.64	.73	.70
3. Visual perceptual span-related words	.70	.59	.69

The preceding results raise the question as to how a large span of perception gives the reader so endowed an advantage over one not so endowed. It is evident that those who are able to use the peripheral vision have a distinct advantage over those who are not. This is probably due to the fact that peripheral vision gives a partial interpretation. Then, when a word comes into direct vision, it has been partially interpreted, and the recognition can be completed more quickly than otherwise.

Hamilton (25) has discussed this point as follows:

> As to what functions the marginal impressions perform in normal reading, assuming that they are approximately represented by my results, our knowledge is likewise somewhat too meagre to formulate any definite theory.

Nevertheless, a sufficient number of facts have been established to warrant some tentative conclusions. In the first place, the right-hand marginal impressions doubtless serve as preliminary partial perceptions of the words, which together with the factor of context, facilitate the full recognition of these impressions when they appear in the area of distinct attention at the next reading pause.

That there is a correlation between the size of the area of distinct attention and that of the right-hand marginal impression is shown by the fact that the area of the former varies inversely as the area of the latter. The constant presence of the right-hand marginal area must be of value, therefore, owing to its preparatory and orienting effect, allowing a more rapid succession of the movements, which more than compensates for the loss in breadth of clear perception entailed by the presence of these marginal impressions.

Dodge (15) has made a study of the same problem. His method consisted in having the subject focus a certain point. This was followed by bringing into the margin of the perceptual field a word or words. This necessitated a movement of the eye before the word came into the focus of clear vision and allowed a pre-vision which had a length which corresponded to the reaction time of the eye. As a result of this, very perceptible differences were found in the time required for interpretation as the material was moved further into the margin of the perceptual field. Dodge's discussion of his results may be quoted:

> The only thing that is distinguishable half or two thirds across the page is a vague outline of the word, a vague word form, . . . In many cases, it would be altogether impossible to recognize the word from this vague outline. In all cases its perception is doubtless delayed beyond the normal preception time for objects at the macula. The question is: What can that vague outline do towards the initiation of the subsequent clear perception? I conjecture that as a stimulus its influence is general rather than specific. I conjecture that the pre-fixational stimulation is a general stimulation of a considerable group of verbal residua. And prolonged observation of the peripheral field supports the hypothesis, since from the shadowy outlines of the peripherally seen words a succession of words may tentatively arise, more or less similar in general appearance, which we may test out by comparison with the peripherally seen word until we find one that fits. In the normal reading process there is no time for any of these suggestions to be tested out; they doubtless never pass the stage of mildly aroused residua, belonging to a general group. As in subsequent fixation the peripherally seen

word comes to the area of clear vision I conjecture that the inhibitory function of clear perception becomes more prominent, shutting out of the competition all the residua aroused by the more general peripheral stimulation except those further stimulated by the new, more definite details.

Another important problem presented by Diagrams IX and X is concerned with the methods by which a few individuals in each group with a much abbreviated span of perception can read at the same rate as those with a large span of perception. This can be explained in terms of attention. The persons with the abbreviated span of perception work at a higher level of attention than do those with the larger span. This probably means that for such persons reading is a difficult task which consumes a considerable amount of energy and results in fatigue. Confirmation of this may be found in some of those persons who do not like to read, and who complain that reading is a laborious process and that they get fatigued quickly while reading.

Still another problem suggested by Diagrams IX and X has to do with those individual readers who have a still wider span of attention than the majority. The explanation of this problem lies again, perhaps, in the level of attention at which they work. They do not put much energy into their reading and, as a result, their reading rate is slow. Another way to characterize such reading is to say that it is easy-going. Doubtless some pupils need to be forced to read more rapidly. If such training were given, it is highly probable that it would result in a considerable increase in their efficiency.

The Effect of Practice upon the Span of Perception. The general problem suggested by this heading was brought to the attention of teachers some years ago in the work of Miss Aiken (1). She was interested in developing accuracy in vision and audition and in quickening all the "perceptive faculties." The material used in her work consisted of numerals, letters, words, etc. The children in her charge had to deal with these various forms of material in many ways. Some of the tasks assigned them were very difficult, and the results obtained seemed remarkable.

These results led Whipple (39) to attack the problem experimentally. This author used nonsense material, such as X M Z P, for training purposes. The material was exposed by means of a short-exposure apparatus. The training period, as stated by this author, was "some six weeks," and the subjects used were adults. He concludes that there is no increase in the span of perception which cannot be explained in other ways.

The next investigator who took up the problem was Foster (18). Instead of using the short-exposure method, this author exposed different types of material such as ink dots, drawings, and photographs, by placing them on a table before the subject. The time varied with the different types of objects exhibited. His subjects were adults. His conclusion is that the training is specific and that it does not transfer to any type of ability except those types closely related to that in which the training is given.

Dallenbach (12) attacked the same general problem by means of a method different from either of those cited above. This author pitched his investigation more nearly upon the plane of observation. His material included numerals, letters, words, and geometrical forms. These were arranged and combined in different ways. The material was printed upon cards and exposed to the class for five seconds. The subjects were second-grade children. The practice period extended over seventeen weeks. While the method varied much from the conditions of reading, yet the results have a general bearing upon the problem at hand. The data show a decided improvement in the amount of material which the children were able to apprehend. This increase was rapid at first and slow in the latter part of the experiment. In discussing the results, the author says:

> The general conclusion which seems imminent here is that training among children has a decided influence upon the span of perception, and that such training persists.

With about the same technique as Whipple used, except that short sentences were exposed instead of nonsense syllables, the writer (22) trained two pupils in the sixth grade for twenty days for the purpose of increasing their span of perception. The results were negative. He then trained two pupils in the third grade by the same technique and succeeded in increasing the span of perception by about forty per cent.

In this connection, Messmer (30) gives as one of his conclusions that the radius of attention grows in children with increasing practice and reaches its maximum probably near the eleventh year.

The importance of this phase of perception for reading cannot be overemphasized. The span of perception with which a reader is endowed is probably due to both maturity and training. Working at a high level of attention may compensate for the lack of a large range of perception; but it seems evident that the person who is endowed with a short span of perception will reach the limits of his accomplishment at a lower level than will the one not so endowed. A perfect science for the teaching of reading will require that the teacher be able to predict with some degree of accuracy the plane of accomplishment which a pupil will be able to reach. When the span of perception in the early grades is better understood, it is altogether probable that such knowledge will be of assistance in making such a prediction.

The importance of this element in reading ability requires that it receive more attention in the methods employed in the teaching of reading. Instead of the rather unsystematic training given with flash cards, a definite plan which is well organized and the results of which are well understood must be devised and employed by all teachers. The mental processes, as emphasized in the work with flash cards, are synthetic in nature and result in familiarity with the total forms of words or larger combinations of language units.

It is true in the case of most children, that the drill and practice given in the regular reading work is sufficient to develop the span of perception to the point which makes for efficiency. On the other hand, there are, without doubt, those children who need much additional drill in order to reach the highest possible point of their development. Such drill will necessarily be mechanical and formal in a large degree. Hence, the problem of maintaining the interest of the child will prevail. Another point which will have to be taken into consideration is the transfer of such training to the reading process. Such training is necessarily separate and apart from the reading. Dallenbach's work shows that there is some transfer to other activities, but methods should be provided to insure a very high percentage of transfer to the reading activity. Still another point to be emphasized is that an increase in the span of perception may involve difficulties in interpretation. This may require radical changes in the method of reading used by the child. Such training may bring about a loss in reading ability until the child has reorganized his method. Yet another fact to be stressed is that such training must come early if it is to be effective. It is probable that the span of perception as a factor in reading ability is fixed early in the experience of the child. Finally, it may be said that when the relation of the span of perception to reading ability is more fully appreciated and proper methods are provided for dealing with the problem, the teaching of reading will have made advancement.

CHAPTER V

QUALITATIVE PHASES OF PERCEPTION

The discussion now passes to a consideration of certain qualitative phases of perception. It is the purpose of this chapter to study different forms and combinations of printed matter, in order to determine which ones lend themselves most readily to apprehension. The question might be stated as follows: What kind of form or arrangement produces the greatest span of perception?

Different Kinds of Printing Type. The importance of reading requires that it be facilitated by every mechanical means possible. It is directly dependent upon printing. In this there are two elements: the kind of type used, and the form of the printing. At present, only the first concerns us. Printing is relatively a late invention which has grown up in a somewhat haphazard fashion, and no great efforts have been made by printers to determine the best kind of type for printing. A few psychologists have attacked the problem. Griffing and Franz (24) found that the larger types are in every instance more legible than the smaller types, and that Gothic letters are more legible than Roman letters. Cattell (9), in his short-exposure work, found the descending order of legibility for capitals to be as follows: W-Z-M-D-H-K-N-X-A-Y-O-G-L-Q-I-S-C-T-R-P-B-V-F-U-J-E. This order was changed very much for lower-case letters. The order for them is as follows: d-k-m-q-h-b-p-w-u-l-j-t-v-z-r-o-f-n-a-x-y-e-i-g-c-s.

Sanford (36) has also worked upon the same problem. He employed two methods. One of these was the same as that used by Cattell, while the other may be spoken of as the distance method. In the second procedure, apparatus was used which e it possible to vary the distance at which the letters were , and the legibility of a letter was judged by the length of distance. Some of the suggestions in regard to legibility e by this author are as follows:

> can be said a priori that legibility will be favored by enlarging the size creasing the differences of the letters. And it is easy to show also that lity is favored by simplicity of outline and concentration of the differ-ions upon one particular. . . . With most of the letters, breadth is r more of an advantage, other things being equal, than length, for it some visibility to their internal spaces. . . . The ceriphs, or little ing strokes of the letters, for example, at the top and bottom of *h* and ds of *s* and *z*, should be made short and rather triangular than linear pe. . . . The concentration of differentia is well seen in the group *q*, where each of the letters is made of a straight stem and a loop, the difference being made in combining the two. All are very legible s except *b*, which suffers from confusability with *h*. An example of f concentration is found in *g* and *a*, which have few points in common other letters and yet are mistaken for many different ones.
>
> e element of size cannot be used to improve the relatively poor letters ut at the same time shocking taste and opening the way for new con-s. It is, therefore, from simplification and emphasis of the points of ence that help is to be expected. In the *c e o* group, for example, the of distinction of *c* and *e* from *o* is the gap in the side, and Javal is right posing a return to the more open forms of the earlier type-founders. The advantage of the wider openings of the *c* and *e* appears in the less ntage of confusion with *o*. The two forms of the Greek epsilon **E** and ϵ, n E, made with square corners like the capital to distinguish it from *c*, st themselves as possible substitutes. . . .
>
> other group of the poor letters includes *a*, *n*, and *u*. The distinction of *u* from each other and from *a* ought to be helped by keeping their open-t the top and bottom as open as possible. . . . Dr. Javal points out rved top of the *a* as a point of resemblance to *n* and recommends a form first letter found in the Italian manuscripts that furnished the mode me of the early typemakers. In this, the top is very small and the loop tively long horizontally, giving the letter the appearance at a distance inverted *r*: ɹ. . . . The great legibility of *v* suggested that its inverted small capital ᴀ, might be substituted (after the analogy of *c*, *o*, *s*, *v*, *w*, *z*) for the present *a*, and it was tested with the "old style" letter Strangely enough, the letter with which it was most frequently con-was the *a* form now in use; had that been omitted, it might have stood derably higher in the list.

Dr. Cattell says that *s* is "hard to see"; and the number of times no answer at all was ventured for it, together with the wide scattering of its confusions, show him to be right. Dr. Javal, too, thinks it a rather hopeless case, but suggests the sharpening of its angles as a way of making it approach the legibility of *Z*. . . . Tests were made, however, on a long *f*, with satisfactory results. The long *s* that is so much like *f* should, of course, be avoided, but great legibility is to be expected from a form that extends both above and below the line; it would, at least, put confusions with *z* and *a* out of the question.

The group with which this form of *s* is most prone to confusion is the long, narrow group, *f*, *j*, *i*, *l*, *t*. Of these, *f* and *j* are good letters when the projections at the top of one and the bottom of the other are made heavy and long enough, as shown by the superiority of the Snellen *f* and *j* over the same letters in the alphabet from Mind. It is preferable if the *s* confusion is to fall anywhere that it should be on these letters rather than on *a* and *z*. The other letters of the group are not nearly so liable to confusion with the long as with each other. Dr. Cattell suggests λ for *l*, and suppression of the dot of the *i*. Dr. Javal would shorten the *t* and prolong its cross towards the left (this, however, chiefly to distinguish it from *f*, the cross of which is to be prolonged the other way); and he would set the dot of the *i* as high above the stem as possible, at the same time making it heavy to avoid breakage, and thickening the stem to match. The value of Dr. Cattell's suggestion for *l* is doubtful. The letter suggested is totally foreign to our Roman alphabet, and, very possibly, would be confusable with *b* and *h* as *y* is with *p*. Removing the dot from the *i* would certainly make it more legible when standing alone, but much more confusable when with other letters in a word. . . . The small capital forms for *L* and *T* were put to the test with unsatisfactory results, partly due, perhaps, to the fact that the letters were made from parts of other letters set together. The *t* difficulty could probably be solved as Javal suggests, and the distinctive point of the *i*, the separation between the dot and stem, could be emphasized by making the stem shorter than the rest of the short letters, though this would hardly be tolerated from an aesthetic point of view.

Roethlein (34) investigated by the distance method the same problem that Sandford undertook. Some of the main points emphasized by this author follow: (1) Width of letters is but one of several factors which contribute to legibility. (2) Legibility is increased by heaviness of face. (3) Isolated letters are invariably read at a greater average distance than are those letters which occur in groups. (4) The varying degrees of legibility tend to be reduced to a common level, as a result of grouping. (5) In groups the most legible face proved to be wholly undecipherable at a distance where the least legible face of isolated letters was clearly and unmistakably legible. (6) Letters likely to be confused with one another were *r v*, *o c e*, *x z*, *u n*, *b h k*, *q y*, *i l j t f*, *M W*, *H K E B D*, *O Q C G*, *V Y F T*, *I J L*. (7) Certain combinations of letters were mistaken for single letters. Examples of this are as follows: *lc* for *k*, *ls* for *k*, *lx* for *k*, *li* for *h*, *cl* for *d*, etc. (8) Certain letters were left out of the readings. This was especially true of slender letters like *i*, *j*, *l*. (9) The position of the letters in groups — initial, final, or intermediate — is an important factor in determining the legibility of letters. The initial position constitutes an optimum condition of legibility. The final position comes next in order and the intermediate position is the least favorable.

Roethlein also gives six factors in legibility. These are as follows: (1) The form of the letter; (2) the size of the letter; (3) the heaviness of the face of the letter (the thickness of the lines which constitute the letter); (4) the width of the white margin which surrounds the letter; (5) the position of the letter in the letter-group; (6) the shape and size of the adjacent letters. In discussing these factors this author says:

> In our experiments the first factor seemed to be less significant than any of the other five, *i.e.*, in the type-faces which were employed in the present investigation, the form of any given letter of the alphabet usually varied between such narrow limits as to constitute a relatively insignificant factor in the determination of its legibility.

The work of Dockeray (13) also deals with the legibility of letters. He concluded: (1) that broad letters were the most legible; (2) narrow letters and some of the tall ones were found to be less legible; (3) confusion between letters seemed to take a definite direction; for example, *f* was judged to be *t* oftener than *t* was judged to be *f*.

Size of Print. The effect of the size of print upon perception has been studied by Judd (29). He had some subjects read very small type and others read very large type. The perceptual process was studied by means of photographic records of eye-movements while reading this material. The conclusion is reached that perception is not modified by changing the size of the type in which the reading material is printed. However, if the size of the type has been increased or decreased still more, there certainly would have come a time when the methods of recognition would have been changed. Such a change would probably have come at the time when the physiological processes underlying perception were changed. In other words, if some of the letters had become invisible, then the method of recognition would have been modified; or if the print had become so large that only a part of a word could be impressed upon the retina at one time, then again interpretation would have been modified.

It is to be regretted that these studies upon various forms and styles of print have had little influence upon teaching of reading. It is hoped that the inclusion of them in works of this kind will lead to a greater interest in them by those who are directly concerned with the hygiene and pedagogy of reading. There are, however, certain valuable suggestions growing out of these studies which should be noted. First, it is altogether probable that there are differences in text-books of reading with respect to the legibility of the print used. There should be definite means at hand for taking this element into consideration in the selection of readers. A second suggestion is that certain errors in reading may arise from the confusion of letters. If two words are much alike and the distinguishing characteristics depend upon two or more letters which are easily confused, the child may easily make an error in calling them. A third suggestion is that there are, without doubt, differences in the legibility of words as well as differences in the legibility of letters. Since the word is often the unit of perception in reading, it is evidently more important that the legibility of words be understood than that the relative value of letters be determined. This would go far toward giving a basis for the selection of words which should enter into the early vocabulary of the child.

The Relation of Letters to the Perception of Words. The question may now be raised as to the relation of the various letters when they are grouped together in words. In his short exposure work, Messmer (30) found that the letters of the alphabet have three main characteristics. These are as follows: Horizontal breadth, vertical height, and geometrical form.

The breadth of letters can be understood by thinking of the number of vertical strokes; *n* and *h* have two strokes, and *m* has three. In the perception of other letters like *o*, *c*, and *e*, width doubtless plays a part.

In regard to height of letters, three classes are to be seen, as follows: those of the line, like *n* and *m*; those which extend below the line, as *y* and *p*; and those which extend above the line as *h* and *l*.

The differences in geometrical form of the letters can be classified in three different ways: first, there are those made of curves, as *o* and *c*; second, those made of vertical lines, as *m* and *n*; and third, those made of oblique lines, as *v* and *x*.

The importance of these various types and forms of letters lies in the fact that they give to words certain characteristics which aid in distinguishing one word from another. Here, again, it is found that these studies have had little influence upon the teaching of reading. Certainly, such work offers an opportunity for a careful evaluation of the words which enter into the early vocabulary of children and, doubtless, such contributions will be made later.

Pillsbury (31) has investigated the relation of letters to perception from another standpoint. His work was based upon the short exposure of mutilated words. By mutilated words is meant words in which letters were omitted, letters substituted or letters blurred. For most of the subjects used there was a decrease in the number of mutilations noticed as the mutilations moved through the words from the first letter to the last. That is, if the mutilation occurs at the first letter there is a greater chance that it will be detected than at any other point in the word. Pillsbury interprets this as follows:

> This seems to indicate a general tendency of the subject to read through the word from left to right, and thus to give the first letters of the word a more prominent part in the recognition of the word as a whole. Consequently, a disfigurement of the first letter was easily recognized, since there was but slight expectation of the word that was to come. When, however, the disfigurements came later in the word the expectation was greater, and the error more likely to be overlooked.

Bagley (2) has reported some experiments which deal with the same general problem as it is found in oral language. His plan was to record mutilated words and sentences upon phonograph cylinders. The subjects were then allowed to listen to the material upon the cylinders and to report what they heard. In this case a mutilated word means one with one or more sounds omitted. In the case of monosyllabic words without context he finds that the elision of the initial consonant affects perception more than the elision of the final consonant.

Other points brought out by Bagley are as follows:

> (1) When mutilated words are given with a minimum of context, the chances for their correct perception are increased by 82 per cent as compared with their chances for correct perception when given without context.
>
> (2) The fact of mutilation is readily noticed in the single words given without context, even though the word be finally correctly perceived: the elision is not so readily noted when the word is given with a minimum of context.

In conclusion, it is evident that letters play a considerable part in the perceptual process as it is involved in reading. Most of the investigations in this field have not been carried far enough to yield practical results; but it seems evident that there are certain factors involved here which might serve as a basis for the selection of words which are to enter into the early visual vocabulary of the child.

Words in their Relation to Perception. Some facts have been obtained which bear upon the relation that words sustain to the process of perception. Huey (28) has emphasized that the first part of a word is much more important for recognition than is the last part. He has also called attention to the fact that the upper part of the word plays a greater part in perception than does the lower part. Still another factor in perception cited by Messmer (30) is the length of words. He says that the length of long words is more often underestimated than overestimated. He also emphasizes that the accurate estimation of the length of a word is a very difficult process, and that the ability is developed late.

Sholty (37) has found that a greater percentage of sight words are known in context than phonetic words. Miss Sholty thinks that, although the children with whom she dealt had had much drill upon phonetics, they did not see these words as wholes, but depended each time upon building them up by the method of phonetics.

Boggs (5) has compared the number of exposures required by means of flash cards to learn letters, syllables, words, and sentences. This author finds that the sentence is recognized more often the first time then any other unit and that the word was recognized more often than the syllable or letter, except in one case, and here the difference was very small.

Only one attempt has been made to study the errors which children make in their reading work from the standpoint of their difficulties in the recognition of words. This study is by Bowden (6). She used six types of evidence in her work. These are as follows: First, certain incidents which happened in the class from day to day were considered. For example, one day when a child was given cards to read, it was observed that she read with equal ease whether the card was right side up or upside down. Second, comments of the children were recorded. To illustrate, the child was asked to find the word "shoes" in the context. While looking for this word, her comment was that the word "dress" looked so much like the word "shoes" that she was afraid she would make a mistake. Third, questions were asked in regard to the methods which the children used in distinguishing one word from another. To illustrate, when the child had mastered the words "sing" and "song" she was questioned as to how she told the words apart. She then pointed to "o" and "i." Fourth, a comparison was made of the words learned with the words not learned as to parts of speech, geometrical form, internal form, and length. Fifth, misreadings were recorded; and sixth, a study was made of the interpretations put upon certain misprinted words as "lalci" for "lilac."

Since this study was made with only six children, the conclusions should not be taken as final; but the method is good, and the findings are given as indicating certain fundamental facts concerning reading ability.

In regard to the parts of speech, the conclusion is reached by Bowden that nouns and adjectives are more easily learned than other types of words. It seems clear that linear words — that is, words which have no letters extending above or below the line — are learned more readily by four of the six children than any other type of word. It is this type of word which is said by Messmer (30) to be most difficult. Another fact brought out by Bowden concerning the form of words is that words composed for the most part of vertical lines are learned most easily, while words made up of curved lines are learned less easily.

Bowden cites the case of one of the six children as indicating that short words and long words are learned most readily and that words of five letters give most difficulty. The conclusion concerning similarity of words is that length seems to be the element which causes most errors, while words similar on account of like letters come second in the number of errors.

It is found by this same author that the children have less difficulty with words shown upside down than with any other type of mutilation. This seems to indicate that children learn words as wholes and that inversion makes little difference in recognition. Miss Bowden suggests in this connection that children have little difficulty in recognizing a toy upside down. Some words were mutilated by rearranging the letters without destroying the contour. An example of this is "nettims" for "mittens." This type of mutilation seemed to disturb the children a little more than did inversion. Other words were mutilated by the substitution of letters. This form of words was recognized much more often than were the other forms of mutilations noted above.

Other mutilations, as those which change length and contour of words, have difficulties attending them; that is, to change the length of a word required the leaving out of a letter, so that not only the length of the word is changed, but also the content of the word is altered. Experiments of these kinds have shown that children are sensitive to such changes.

Finally, the author says:

> The comments and questions as well as the misreadings seemed to show that children learn to read words by the trial and error method. It may be the length of the word, the initial letter, the final letter, a characteristic letter, the position of the word in the sentence, or even the blackness of the type that serves as the cue. . . . There is no evidence in any of the cases studied that the child works out a system by which he learns to recognize words. . . .
>
> Under the methods of instruction employed with this class as outlined above, it appears that these beginners in reading have after two months or more of instruction secured a sufficient conception of the general appearance of a very limited number of words to recognize them as wholes, that in doing this they made use of only very general cues or points of differentiation between words and parts of words. It appeared very doubtful to the experimenter whether, under this method of teaching words as visual wholes, the pupils would, of themselves, have come to make this latter necessary analysis with much success.

Some details concerning the analytic process emphasized by Bowden have been given by Hamilton (25). The data upon this point were collected by means of the short-exposure experiment. The subjects were required to report in detail upon that part of the material which was perceived in the margin of their consciousness and about which they were uncertain. The passage quoted below gives the points determined by this author:

> The following five distinctions, or partial readings, were frequently noted: (1) Partial substitutions. By partial substitution is meant any reading in which one or more letters were found in common between the word actually present and the one which was substituted for it. (2) Total substitutions. By a total substitution is meant a case where there was no letter in common, the only point of identity being the general appearance of the word present and the one substituted for it. (3) Correct forms of words. In this case the subject could not make a judgment as to what the word was, but was able to describe its general appearance, perhaps giving the number of letters and a general description of the letters, such as their shape, size, and position within the word. (4) Incorrect form. Here the subject saw clearly the word impression as a whole, but failed to describe correctly the form or size of the word, the number of letters, etc. (5) No form. In many cases, subjects were certain of the presence of one or more words in the margin, of whose form they could report nothing whatever. In such cases, they were absolutely certain of the numerical aspect of the words present in the margin, though they could give no other quantitative characteristic, and nothing whatever of the specific qualitative character.

It is not too foreign to the topic in hand to emphasize that the work which has been done upon the relation of words to perception evidently has considerable importance in the correction of the mistakes in oral reading. There is no doubt but that the time given to oral reading is to be reduced and that the work which is done in it is to have a much more definite aim. One modification in the methods of teaching oral reading which would be of very great value relates to the plan for correcting errors. It should be clearly understood by the teacher that many mistakes have a definite meaning and a definite reason. If a rational system of dealing with these errors were provided, the error would not be repeated many times. In the past, teachers have been content merely to call attention to the error while the child continues to make the same type of error week after week. It seems, sometimes, as if children are called upon to read in order that their teacher may determine whether all the errors which they are accustomed to make in reading are present.

The Length of Lines. Another factor which seems to influence rate of reading is the length of the lines in which the material to be read is printed. Dearborn (11) has presented evidence to show that a line about one third longer than the usual newspaper line is one which has distinct advantages. According to this author, the most efficient reading is done where rhythmical movements of the eyes can be easily established and where there is opportunity for the continuation of such movements after they are initiated. Rhythm, as defined by this investigator, has in it two elements. The first of these elements requires that there be the same number of pauses for the different lines read. The second element requires that the long and short pauses of the eye arrange themselves in a definite order. This order of the pauses usually begins with one longer than those that follow and is succeeded by a secondary increase in their length toward the end of the line.

Rhythm can be established most easily in the reading of short lines because peripheral vision can function best under these conditions. This is true because with lines of this type there is allowed a prevision of the greater part of their length, while if the lines are long no such prevision can take place. The partial interpretation allowed by prevision makes it possible for the reader to proceed much more rapidly along the line than if the partial interpretations were not present. Peripheral vision can also function better in an up-and-down direction in the case of short lines than in the case of long lines. This is true because in the long lines the meaning of the material above or below the line being read is apt to be so far removed from the meaning of the line on which the eye is focused that peripheral vision can be of very little assistance. In his discussion of this point, Dearborn has also called attention to the fact that many text-books are printed with lines of varying lengths. Such printing does not allow rhythmical movements of the eyes to be established easily and readily. The different lengths of lines result many times from the insertion of illustrations on the pages in a manner which breaks the lines into small parts. The discussion of this point by Dearborn has done much to improve text-books in this respect.

Another View of the Qualitative Factors in Perception. It has been emphasized that there are qualitative differences in material which make for differences in perception. Certain individual pupils have been shown to be more sensitive to such differences than are others. This is equivalent to saying that the perception of differences in words depends upon a special ability. This ability is a type of observation. The same kind of mental activity is used by the geologist who notes small differences in stones, as well as by many other scientists in their daily work. Such skilled observation grows out of practice and knowledge. From this standpoint the pupil who observes critically and sees small differences between words, other things being equal, is the most efficient reader. Primary teachers recognize that there are differences in children in their ability to recognize such differences in words. Many studies have been made which show clearly that children are very inaccurate in their perception of phenomena about them. The very inaccurate observations made by children in other respects suggests the probability of inaccuracies in their perception of words. They must be made accurate and practiced in their observation of words. They must be made expert in this type of observation, just as the biologist or the geologist in his observations.

Another consideration which adds to the difficulty here is that the differences between words are not very great. If words differed greatly in their form special training would not be necessary. One purpose of phonics is to give the child the ability to detect differences between words so that his observation of such differences may be made systematic. This is fundamentally a process of analysis and is necessarily tedious and slow at first, but experience and training make it both rapid and accurate.

The qualitative phases of perception may be summarized under five heads, as follows: (1) Material when grouped and arranged in one order may have meaning while the same material arranged in a different manner may become nonsense material. (2) There are differences in letters and words which make certain ones more legible than others. (3) Differences in letters and words must be accurately perceived if efficiency in reading is to be obtained. (4) Slight changes in the size of print do not affect the process of perception. (5) The length of lines is an element in the perceptual phases of reading. (6) Accuracy in reading depends upon the ability to perceive accurately and readily the small differences which exist between printed language forms.

CHAPTER VI

METHODS OF PERCEIVING WORDS: DIAGNOSIS BASED UPON PERCEPTION

It remains to deal with perception as a process. Certain suggestions which have been given upon the problem will be elaborated and others added. Experimental data will be considered first.

Upon the basis of his experiments, Messmer (30) has divided readers into two classes, as follows: subjective and objective. Readers of the objective type depend upon the dominating letters in a very large degree. Their span of perception is very limited, but their accuracy is high. This indicates that they do not depend upon the total form of the word in any large degree but that their familiarity with the word depends upon analysis. These points, taken in connection with other facts concerning perception, indicate that there are two types of readers who have a short span of perception. First, there are those whose native ability is such that their span is very short; and second, there are those whose span is short because they must have many different cues before the process of interpretation is started. The second class is of great interest to teachers, because training may produce this type. Messmer states that there may be a contraction of the span of perception after the eleventh year, and a revision to the objective type. It would seem, too, that continual dealing with small units, as is true in the case of oral reading, may fix habits which would lead to extreme forms of the objective type.

The subjective type neglects the dominating letters and depends upon the total form. The attention of this type is designated as wandering. As a result, there is not a strict adherence to the objective material. There is also a large associative contribution made by such readers in the interpretation of printed material. Their reading is rapid, but it is not accurate. Again, it seems that there are two types of readers with a long span of perception. First, there are those whose span is long on account of native ability. Second, there are those whose span is long because their interpretative processes are set going by a small number of cues. Whether this second type is produced by training is not known. The method of interpretation used by these readers may grow out of carelessness. It would seem also that the child who reads a great deal and so develops the habit of rapid reading might develop those tendencies which would put him in the subjective class.

The efficient reader must be guided in an accurate way by the objective material, but, at the same time, this must be dealt with in large units. This means that interpretation will proceed sometimes by guessing, sometimes by association, and sometimes by reasoning, and probably in other ways not well understood. There must be freedom in dealing with the objective material. This is not a freedom which runs riot, but rather a freedom which grows out of a wide experience with language forms. Such experience results in a familiarity with language which allows the interpretative process to proceed rapidly and easily.

A comparison of some of the results obtained by various tachistoscopic investigations is also of interest in dealing with perception as a process. The work of Cattell (9) previously mentioned was followed by that of Goldscheider and Müller (21). These authors called attention to the significant fact that the unit of perception might vary with conditions. Their statement was that the unit might be at one time a word, and at another a phrase or a short sentence, and at still another a letter. The change in the unit, according to these authors, was due to the degree of familiarity of the material read and to the purpose of the reader. These investigators also held that perception was mediated by certain characteristic letters rather than by word wholes.

This point was disputed by the next investigators in this field, Erdmann and Dodge (16). These writers were skeptical of the application of the results of Cattell and Goldscheider and Müller to reading, because the exposure time used by them had been much shorter than the perception time involved in reading. More nearly to meet the conditions of reading Erdmann and Dodge adopted an exposure time of one tenth of a second. With this modification of the technique, they came to the conclusion that the total word form is essential to the perceptual process rather than characteristic letters as emphasized by Goldscheider and Müller.

The work of Erdmann and Dodge was followed by a theoretical discussion of Wundt (40) in which he asserted that the perception of long words must be conditioned by a movement of the attention over them. Zeitler (40) then undertook to demonstrate experimentally this theory of Wundt's. He gave over six thousand exposures and used a very short perception time. He agreed with Goldscheider and Müller in their theory that perception is mediated by characteristic letters rather than total word forms. He also elaborated Wundt's theory that perception is conditioned by a movement of attention over the word when the words are long. The results upon this point were procured, largely, by introspection. The movement of attention apparently varied with different lengths of words and with different exposure times. Dodge (14) criticizes these introspections in the following words:

> It becomes evident, from the whole discussion, that the objective succession, and the wandering of the attention actually found in consciousness are in reality not a function of the visual apprehension but of the motor acoustic interpretation of the visual presentation.

Zeitler says that a word may be read in two ways. First, there is apperceptive reading. This type of perception is an immediate process conditioned by the objective material.

Second, there is assimilative reading. This is a mediate process and requires some time for its accomplishment.

The next investigator in the field was Becker (4). He agreed with Erdmann and Dodge and Cattell that perception is mediated by word wholes and that there is no wandering of the attention. The last investigator who worked upon this problem by means of the short-exposure experiment is Messmer (30). His investigation was elaborate and his conclusions agree substantially with those of Goldscheider and Müller and Zeitler.

The problem of whether the perception of words involves a movement of attention over them was later attacked by Dearborn (11). His data were collected by means of eye-movement records rather than by means of the tachistoscope. He assumes that in work of this type movements of attention are accompanied by movements of the eyes. His first experiment consisted in photographing the eyes while short phrases and sentences were perceived. It was thought that if there was a wandering of attention in the perception of this material, such movements would show in movements of the eyes. The results were negative. A later experiment consisted in photographing the eyes while numbers composed of four or five digits were read. Very marked movements of the eyes were found in this experiment. This is taken as evidence that the numbers were perceived by a wandering of the attention over them. Dearborn argues that if the recognition of words involved successive acts of perception there would also appear movements in the records of the eyes taken while perception of this type was in progress.

In certain instances this author found movements of the eyes which can best be described as small shifting movements. Such movements would seem to indicate successive acts of perception, but he explains these findings as the result of slow assimilation.

To Dearborn most of the wandering of attention cited by the various authors previously mentioned means only a shortening of the span of perception. If there is success in forming unitary groups, the span is large; but if there is failure in forming such groups, the span of perception is reduced to the point where some type of grouping can be accomplished.

This brief survey indicates rather clearly that the various investigators have emphasized two types of perception or two phases of the same process. One of these seems to be immediate and instantaneous, while the other is a process which is somewhat retarded. The dispute in regard to this matter has centered about the nature of the perceptive act of the second type. The particular point which has been so strongly contested, is whether in perception of this type there is a wandering of attention, and if so, what is the nature of such movements of the attention. Critics apparently do not object so much to the statement of Zeitler and others that there is a movement of attention over the words, but rather to the statement that the movement is from letter to letter even if these letters are the dominating or characteristic ones rather than successive ones. In this connection Dodge (15) may be quoted again, as follows:

> To speak of the perception of a word in ordinary reading as a successive process seems to be altogether in harmony with the facts. In general, it would be difficult to conceive of a *process* in which there was no succession, and we have demonstrated experimentally that the perceptual processes in reading may begin one or more fixations before the specific word is directly fixated — if indeed it ever is fixated. But to insist that this succession in the perceptual processes necessarily involves a successive apprehension of letter units seems to me as absurd as would be the contention that we cannot perceive a house without a successive apprehension of the clapboards and shingles, at least the "dominating" ones. To insist on the other hand that such a successive apprehension of the letters is impossible would be equally absurd, provided they fell within the area of relatively clear vision.

Those who have emphasized perception as an immediate act have used, to a large extent (not always), easy and familiar material, whereas the wandering of attention was found by Zeitler in such words as "taubstummenlehrer." From this, it seems that the point at issue is the difference between the perception of familiar material, on the one hand, and the perception of unfamiliar material on the other.

From a slightly different standpoint it appears that the fundamental problem at hand is the difference between perception as a synthetic process and perception as an analytical process. The place and the value of the analytical phases of perception have been well brought out by Hamilton (25) as follows:

> In the majority of cases, little further analysis is necessary, the general characteristics of the word being the principal cue by which it is recognized. But when some unfavorable condition arises or when the words are strange or difficult, additional distinctions within the word are required, in which case the parts of the word must be brought more or less clearly to consciousness according to the degree of the complexity or unfamiliarity. It is probable, however, that a certain amount of literal analysis always takes place in some of the words, even under the most favorable conditions, owing to the peculiar structure of the visual apparatus, to the chance direction of the attention, and to the prominence of certain letters due to their size, peculiar structure, or to their more or less favorable position within the word. But, as a rule, conscious resort to such analysis occurs only when the word presents some special difficulty and spontaneous recognition by means of the more general attributes of the word fails. The form of procedure may, therefore, be described as predominantly synthetic-analytic, the amount of analysis tending in general to decrease with growth in ability and with increasing familiarity with the material read. Something doubtless depends upon the peculiar mental habits of the individual, possibly also upon the methods employed in learning to read.

In conclusion, it is probably true that the fundamental character of this analytical type of perception is not thoroughly understood. Indeed, as Dodge has pointed out, it may be that the short-exposure method is not the best method to be used in the investigation of this problem. However, that there is a real problem here which has very great importance in reading ability and in the training of children will not be denied by any one and, without doubt, it will have further light shed upon it by investigations of the future.

In addition to the experimental evidence which has just been cited, there are certain very common experiences in the perception of words which may be easily observed, and which are of interest at this time. A few of these will be discussed. In this connection, a comparison of the recognition of people and the perception of words may be made. If we are asked how we distinguish between a giant and a dwarf, it is difficult to tell, because the differences are so great and so many that any systematization of them is hard to make. On the other hand, if twins come among our acquaintances, the matter of differences becomes a real problem and it is necessary that some point or points of difference be found, if confusion is to be avoided. In some cases, these differences may be reduced to a single one as the length of an ear lobe, or some other small detail. Even after such a characteristic is determined upon, it is difficult to remember which one of the twins possesses the distinguishing characteristic.

Likewise there are giants and dwarfs among the words in our vocabulary, and there are other words so much alike that they may be thought of as twins. To illustrate, it would be a very rare case when difficulty arose in distinguishing such words as "consciousness" and "ox." There may be inherent difficulties in each, but there is nothing which would lead to a confusion of the two. If all differences between words were this great, they would present few difficulties, and learning words synthetically would suffice for all reading.

On the other hand, two words like *what* and *that* or *the* and *they* may be twins in the mind of the child, and in order to avoid confusion the child must learn just where to look for the distinguishing characteristic. It will be seen that such a process involves trained observation such as is exhibited by naturalists. It requires analysis and is acquired only after training and experience.

Again, it is a common experience that one may know a person in a certain environment and not know the same person in another environment; for example, it is possible to consult a professional man in his office several times, and not recognize him later on the street or in the club. When such a person is met outside the office, there may be a feeling of vague familiarity concerning him but nothing definite about the previous experiences. The same point holds with respect to words. A child may know a word perfectly well on one page in certain surroundings, but on the next page, when the word is seen in new surroundings, he may be utterly unable to recognize it. This is a common experience with those who are learning to read a foreign language. They may be able to recognize and use a word on one page of a text-book, but when the same word is found on another page in a different sentence or paragraph, they fail completely to recognize it. This emphasizes the fact that, in dealing with words, a vague feeling of familiarity will not suffice. The mental operation must be on a plane of recognition which involves details of knowledge.

Furthermore, it is possible to recognize a person who has his hat on and fail to do so when this person has his hat off; or it is possible to recognize a friend dressed in one suit and fail to do so if the suit is changed. In the same manner, if a word is learned first with its diacritical markings, it may not be recognized without these markings. Besides, a child may recognize the word "hit" and may be able to deal with it in an intelligent manner, but "hits" may be a stumbling block. Not only may the child fail to recognize the word, but he may also fail to see anything in it which is familiar. This only serves to emphasize the fact that the recognition of words is a highly specialized activity. Each word is an individual, and sometimes conditions are such that recognition takes place entirely as a synthetic process, while other words may be of such a nature that perception must begin with analysis.

Though there are many more experiences of this type, the foregoing are sufficient to give teachers a basis for the recognition and classification of many activities which enter into the perception of words. If these experiences and others similar to them were more often taken into consideration by teachers, their work in reading would be placed upon a different basis.

The last point to be emphasized in this connection is that perception is an act and, as such, involves many of the elements of habit. In discussing this point, Huey (28) makes two general observations, as follows:

> (1) Perceiving being an act, it is, like all other things that we do, performed more easily with each repetition of the act. (2) Again, as in the performance of any act, a perception may involve more and more complex constituent acts as these are progressively welded together by practice, and especially as they become synthesized to a total performance which may be set off from a single consciousness cue.

In summarizing the chapter, it may be emphasized that the nature of perception as an act is not well understood by either psychologists or teachers of reading. That phase of the perceptive act which seems least understood and at the same time highly important in the reading process is analytical in its nature. There is here a field for further investigation which promises to throw very helpful light upon the problems of reading.

The Diagnosis of Reading Ability

Analysis as a Basis for Diagnosis. The discussion in the last three chapters reveals at least two types of ability which are fundamental to the reading process. These are the span of perception and ability in observation.

Tests to be Employed. Two tests suggest themselves at this point. These are the voice-eye test as employed by Quantz and the short-exposure test. Each of these can easily be conducted, as will be shown in a later chapter. These tests will serve as a basis for the interpretation of results which are obtained, upon rate and upon comprehension, by the standards of oral and silent reading tests previously discussed.

Interpretation. The discussion of perception has made the following contributions to the problems suggested in the earlier chapters: (1) The knowledge of isolated words is of two kinds. First, a word may be known as a unit or as a whole; and second, the knowledge of words may be based upon analysis. (2) Mispronunciations and substitutions may result from mistakes in perception. In such cases, the pupil does not have the ability to detect small differences between the words. This lack of ability may be due to lack of knowledge concerning the details of word forms or to a habit which neglects details. (3) The rate of reading has been shown to depend upon the length of the span of perception, and upon familiarity with language forms. (4) The laws of perception show that if the span of perception is long, so that the units by which interpretation proceeds are large, comprehension is very much enhanced. On the other hand, if the span is short and the unit small, comprehension is retarded. Again, interpretation may be inaccurate because the ability to observe differences in words is not present. It has also been suggested that the development of the span of perception gives rise to certain difficulties in comprehension. That is, the short span of the early years of the child requires one method of interpretation, and the longer span resulting from maturity and training makes a more efficient method of interpretation possible. The transition period from the first to the second may involve difficulties for certain children. (5) The relation between rate of reading and comprehension has been shown to depend upon the span of perception. A long span of perception makes for a rapid rate of reading and a high efficiency in interpretation. A limited span of perception makes for a slow rate of reading and inefficient interpretation. Reading which is efficient or inefficient in both rate and comprehension can be explained, then, in terms of the length of the span of perception. For those cases where a slow rate is combined with high efficiency in interpretation, or where a high rate is combined with an inefficient method of interpretation, these chapters have some contributions to make. It seems that readers of the first type depend too much upon the external stimuli, or they require a large number of stimuli to start the process of interpretation. On the other hand, readers of the second type interpret upon the basis of too few stimuli.

Questions and Exercises

1. From the standpoint of developing the span of perception, training b means of flash cards would seem to be an excellent procedure. What precautions are necessary in order to be sure that such training functions in th reading work? How could the technique of such work be improved?

2. What objections are there to having children study words with diacritical marks?

3. What suggestions can you give for developing the span of perception in the first and second grades? Would requiring children to look up from their books while reading be of benefit?

4. What is the effect of holding the book too near the eyes?

5. Make a list, say, of one hundred errors made by your pupils and study them in the light of the laws of perception. What are the causes of each error from the standpoint of perception?

6. Can you cite cases where differences in reading ability were due to differences in the span of perception as indicated by a child's ability to look up from his book while reading?

7. Can you cite cases where differences in the reading ability were due to differences in observational abilities?

8. If the old alphabet method succeeded in teaching children to read, why is it criticized so seriously?

9. Does the child have to know the alphabet in order to read? Why?

10. In the light of the preceding chapters, what are the objections to place-keeping devices? Are these objections valid with regard to a ruler or a sheet of paper marking the entire line?

11. Can you give devices for developing observational ability with respect to letters and words?

12. Would you attempt to explain any of the laws of perception to children? If so, what ones?

13. From the standpoint of the laws of perception, how should omissions be dealt with? Insertions?

14. Could Quantz's form of the voice-eye test be used as a means for developing the span of perception? Would it be feasible to allow children to use this test one with another?

15. How could you tell if a child's difficulty consisted in the use of too long a span of perception?

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C. THE ANALYSIS OF READING ABILITY FROM THE STANDPOINT OF THE MOTOR PROCESSES INVOLVED

CHAPTER VII

THE ORGANS OF SPEECH AND THEIR COÖRDINATIONS

General psychology has emphasized in many ways the importance which attaches to various motor activities as they are related to different mental processes. Only casual observation is necessary to show that the mental processes involved in reading are accompanied by motor activities which are of such a character as to demand careful study. To illustrate, if one observes silent reading, it will be noted that movements of the eyes are always present. In addition to this, the silent reading of many children shows the presence of vocal reactions and extraneous movements. If oral reading is observed it will be found that eye-movements are present, that vocalization movements are more pronounced than in silent reading, that the breathing movements are coördinated in a way not to be noted in ordinary breathing, and that there may also be certain extraneous movements.

It is the purpose of the writer in the next four chapters to study the motor elements of the reading process. This will result in an analysis of reading ability such as is required by diagnosis. The topics with which the discussion is concerned may be classified as follows:

I. Vocal movements
  A. The organs of speech and their coördinations
  B. Rate of vocalization
  C. Vocalization during silent reading
  D. Breathing movements in oral reading

II. Non-vocal movements
  A. Eye-movements
  B. Extraneous movements

The discussion will now pass to a consideration of the problem suggested in the title of the present chapter. Reading makes use of all the organs involved in speech. The control of these various organs is acquired very early by the child, and as a result little or no instruction is necessary in the primary grades with respect to the coördinations required in this phase of reading. Because of this, few teachers realize that speech is a highly complicated process involving many muscles which are so coördinated as to allow highly specialized and delicate movements to be made. However, if one is called upon to instruct a deaf and dumb child in oral speech, the complexity of the process is brought clearly to mind, because such instructions must be based upon a thorough analysis of the speaking activity. Following such an analysis, directions must be given for the use of the various organs of speech so that the child may be able to employ them in the proper order and in the proper way. Such methods are made necessary, in the case of the deaf and dumb child, by the fact that the muscular control involved in speech is not acquired through the ear.

Again, a teacher of phonics encounters a problem similar to that in the instruction of the deaf and dumb. To be able to deal with words successfully, as required by phonics, the child must know the sound of each letter and the proper coördinations of the muscles required to make the sound. The difficulty in this operation lies in the fact that the child has learned to make these sounds not as separated one from another, but rather as connected and related to other sounds. The relations which exist between the different sounds which go to make up a word lead some authorities to think that, instead of there being a series of motor impulses which produce the different movements involved in making sounds as they occur one after the other in a word, there is only a single stimulus for an entire word. If this be true, the problem of the child in phonics becomes one of analysis, in that he must be able to divide words into their component sounds. This must be followed by the coördination of muscles in the speech organs in order that the single sound may be made. Even if the child is able to make a sound in connection with other sounds, his ability to make it singly is not assured.

The composite nature of speech has been stressed by both Scripture (32) and Sweet (37). Scripture holds that speech is continuous in nature, and that there are no breaks which correspond to letters, syllables, and words. In this connection he says:

> A word is a continuous series of an infinite number of sounds and the letters indicate in an incomplete fashion nothing more than certain characteristic points of this series.

In discussing the same general problem, Sweet says that the only divisions made in speech are those which divide it into "breath-groups." Within these breath-groups there are no pauses. According to this author, variations in force or stress make it appear that the flow of speech is broken into parts. It must also be true that the many changes in pitch which are involved in speech produce the same effect upon the hearer.

As a basis for further discussion, the problem will be divided into two parts, as follows: (1) the description of the organs of speech, and (2) the coördination of these organs as they function in reading.

The Organs of Speech. These organs may be enumerated as follows: the larynx, the pharynx, vocal cords, soft palate, upper and lower jaws, lips, tongue, nasal passages, certain cavities in the bones of the head, and the breathing apparatus.

The Breath. In making any single sound the function of the breathing apparatus is to force the air through the different speech organs. In passing through these organs it comes in contact with different obstructions. It is this contact of the air with the speaking parts acting as obstructions which produces the sounds that compose a language.

The Larynx and Pharynx. One use of both the larynx and the pharynx is to serve as a passageway for the air from the lungs. A second use emphasized by certain authors is that they serve as resonance cavities for the sounds made by other organs.

The larynx has one other important function. It contains the vocal cords. The cords are not bands, as it is usually thought, but can better be described as cushions composed of connective and muscular tissue. The larynx is composed of a number of cartilages, and it is to these that the cords are attached. The various muscles of the larynx help to change the shape of the cords. It is the cords which offer the first resistance to the air as it passes from the lungs. If they are in the proper shape and have the proper tension, they set the air to vibrating, and the result is a sound. If the air rushes through the cords without being made to vibrate and meets other obstructions later, the result may be a whisper instead of a tone. A whisper, then, is oral language minus the sounds made by the vocal cords. The particular sound which is made by the vocal cords depends in a large measure upon the shape of the opening between them. The control of the movements of the cords is almost entirely an unconscious process, so that instruction plays only a small part in the development of such reactions.

The Tongue. The function of the tongue is to change the shape of the mouth cavity. These changes modify the resistance offered to the air as it passes through the mouth. In the sound "ah" the tongue is flat on the bottom of the mouth, while in the short sound of "i" the back of the tongue is raised and the tip is drawn backward. In some other sounds, as that of the letter "t," the tongue is first placed against the teeth and then suddenly withdrawn. This organ is probably the most mobile of all the speech organs. The accurate use of the tongue is a phase of phonics which often gives children difficulty. These difficulties are lessened many times by drawings and charts which show the proper positions of this organ for particular sounds.

The Lips. These organs also have the general purpose of changing the shape of the passage through which the air must pass. In making the vowel sounds they have the shape of an oval. The size of the oval varies from sound to sound. In the sound "ah" the opening of the lips is larger than is required in any other vowel sounds, while in short double "o" it is much smaller. In some sounds the lips are first entirely closed and then suddenly opened. In still others the lower lip is brought in contact with the teeth, and the air is forced between the lips and the teeth. This is true in sounding the letter "f." In teaching the proper use of these organ charts, drawings, and demonstrations may be employed by the teacher of phonics.

The Jaws. It is the function of these speech parts to carry the lips and teeth into proper positions for making the different sounds. The movement of the lower jaw increases or decreases the size of the mouth cavity which changes the resonance property of this organ. The raising or lowering of the jaw also helps to bring the tongue and lips into their proper positions.

The Resonance Cavities. The chief function of the nasal passages is to serve as resonance cavities. It is impossible to change their form in a voluntary way except in a slight degree. However, if the shape of these passages happens to be modified by an operation for adenoids, or if the nasal passages are affected by catarrh, the voice may be changed slightly. The relation of the nasal passages to any sound is determined in a large part by the position of the glottis. This organ is at the back of the mouth. In some positions it may almost close the nasal passages, while in others it may leave them entirely open.

Certain hollow places in the bones of the skull are also supposed to function as resonance cavities. There are many differences of opinion as to the extent of the effect of these cavities upon the voice. Attention has already been called to the fact that other organs, such as the larynx, the pharynx, and the mouth, have a resonance function. It is for this reason, in part, that the professional vocalist has his voice carefully at-ended to by an expert physician. The removal of any part y an operation or the disease of any part might bring about great change in the quality of his voice.

Speech Defects. Anything which seriously affects the movements of the various vocal parts will result in speech defects. Tongue-tie is due to the fact that the tip of the tongue cannot e moved as it should be. The absence of teeth during the econd dentition period, hair lip, cleft palate and lack of proper reathing coördinations are all examples of defects of speech hich grow out of a lack of free and unhampered functioning f the speaking parts.

Coördinations of the Speech Organs. It is now of interest to ote the total number of coördinations which must be brought bout in order to produce such a sound as "ah." These are s follows:

1. The jaws are open so that the teeth are from one half to ne inch apart.
2. The tongue is flat upon the floor of the mouth. Its tip d edges should touch the inner portions of the teeth.
3. The lips should be at rest upon the teeth.
4. The soft palate must be raised so as to obstruct the nasal ssages.
5. The larnyx is drawn down slightly.

This brief description should emphasize the complexity of the eaking act. Here are five separate coördinations, all of which st be accomplished almost at the same moment. In most tances, to do five things at once is considered a difficult feat; t in this case such an act is passed over by the teacher with le thought, and if the pupil fails to produce the sound propy, she has little patience with his difficulty.

It is impossible to give a full discussion of all the sounds at s time; so it may be well to conclude with a table (see page 7) by Aikin (3), which shows in some detail the coördinations different consonant sounds.

The chapter may now be closed by a further discussion of

phonics. Phonics is essentially an analytic process. It m
the breaking up of oral speech into its various sounds.

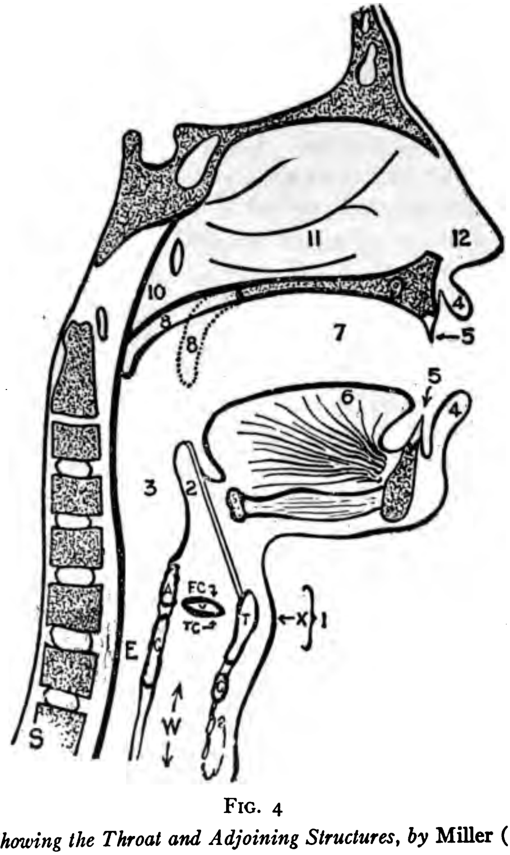


FIG. 4

Showing the Throat and Adjoining Structures, by Miller (26)

1, Larynx. 2, Epiglottis. 3, Lower Pharynx. 4, Lips. 5, Teeth. 6, To
7, Mouth (Oral Cavity). 8, Uvula and Soft Palate. 9, Hard Palate. 10, U
Pharynx. 11, Nasal Cavities. 12, Nose.

A, Arytenoid cartilage; *C*, Cricoid cartilage; *T*, Thyroid cartilage; *W*, W
pipe; *X*, Adam's apple.

speech is for the child a highly synthesized process. Oral w
are units or wholes, and in no sense are they broken up into t

various parts. Some authors hold that the nervous mechanism by which speech is accomplished is such that only a single stimulus is necessary to excite the muscular reactions involved in an entire oral word. If this view be correct, the analysis required

Table XIV

Showing Various Elements in Consonant Sounds, by Aikin

Where formed	Incomplete Closures				Comp. Closures		
	ASPIRATES	CONTINUANTS (sounding)			EXPLOSIVES		
		Buccal non-nasal	Nasal	Tremor	Un-voiced (hard)	Voiced (soft)	
1 Larynx	H						Jaw open
2 Tongue (body) and Hard Palate (back)			NG		K	G	
3 Tongue (tip) and Hard Palate (front)		L	N	R	T	D	
4 Lips			M		P	B	Jaw partly open
5 Lower Lip and Upper Teeth	F	V					
6 Tip of Tongue and Upper Teeth	TH	TH					
7 Teeth	S	Z					Jaw closed
8 Teeth (with lips)	SH CH= TSH	J (soft) G= J DJ					

by phonics is an entirely new problem for the child and should not be thought of as a part of an old problem. It is new from the nervous standpoint in that it probably involves a different nervous mechanism from that employed when the sound is dealt with as one of a series of sounds. It is also new in that the child has to become more or less conscious of the speaking parts and of the relations which they bear one to another. Again, this problem of phonics is new in that an association is built up between the sound and the written or printed symbol.

The work of phonics is also synthetic. After the child has made the proper analysis and is able to make the sound which should accompany each letter in a word, there is still the problem of synthesizing these sounds so that they become a word. In this connection one of three situations may confront the child. First, he may be dealing with a word which is in both his visual and his oral vocabularies. In such cases the synthesis is usually easy, because he has in mind the end to be obtained. Second, the child may be dealing with a word which is in his oral vocabulary but not in his visual vocabulary. Here the child does not know which of the many known words in his oral vocabulary is sought by the synthetic process, but he may be able by the trial and success method to build up a word which is recognized as belonging in his oral vocabulary. The difficulty lies in the fact that the particular end sought is not known. The situation is such that, if this end were known, the problem would be solved. Third, the child may be confronted with a word which is in neither his oral nor his visual vocabularies. In this case, the word is wholly new to him, and the attack must be made by the trial and success method, the only available guide for determining the final result being the child's general knowledge of language. Help may be gained from the context, but in many instances the child is called upon to deal with isolated words.

The factors entering into those abilities which make for analysis and synthesis are not well understood. They probably depend upon native ability, maturity, and training. The greatest error which has been made in the development of these abilities is the assumption that training in the primary grades is sufficient for all pupils. The majority of children may receive ample practice during this period, but evidently there are large individual differences in these abilities, as in many others, and in order to meet such a situation training should be continued into the third year for some and into the fourth year for others. It may be argued that this is not done in other subjects and cannot be done in reading. The answer to this is that the problem here is a fundamental one in a fundamental subject of the curriculum, and if facility in these processes is not gained early, the child is hampered not only in his reading but in all other work as well. Another problem which prevails in this type of training is the transfer of ability in phonics to the reading work proper. The child may do well in phonics but may not be able to apply his training in the reading which he is called upon to do.

The discussion so far has emphasized analysis and synthesis as they relate to the building up of a new and larger vocabulary. It is also true that the same methods may be used in correcting mispronunciations. For instance, a child may insist on saying "val" for "valve." If the child is made to analyze such a word into its various sounds, and then to synthesize these sounds into the proper word, a better appreciation of the correct word is given than if the correct pronunciation alone is given.

The processes of analysis and synthesis treated thus far have been oral in their nature and application. At a later stage the oral elements which enter into these processes can be very much reduced, and they then become almost entirely mental. The child who uses the dictionary readily and accurately for pronunciation has reached this second plane. He is able to look at the diacritical marks and to proceed immediately to the correct pronunciation without the intermediate steps used by the child in phonics. To reduce the oral elements in phonics is evidently one of the important purposes of such training.

Another phase of this problem is found in the general attitude taken by different pupils toward words. To deal with words successfully, both an analytic and a synthetic knowledge of hem is necessary. As reading is usually taught, synthesis is developed first and is followed by analysis. In some cases this procedure apparently fixes the synthetic method so firmly that t becomes, for the pupils so taught, a method of approach to all language. A few children of this class have great difficulty in acquiring the analytic method of approach, and some apparently are never able to do so. Many times those who do not avail themselves of the analytic method are careless and inaccurate in their methods of dealing with words. It will be seen that training in phonics tends toward the analytic method of dealing with words, and from this standpoint is highly important, because it is at the basis of an accurate knowledge of words. The danger in such training lies in the fact that the pupil may become so thoroughly dependent upon the objective process in his approach to words, that he loses his subjective approach. Such a pupil is restricted in too great a degree by the details of the word, and too little is allowed for interpretation. Under these conditions reading will necessarily be slow and tedious.

The process of analysis which has been emphasized so far involves only the analysis of words. There is, however, another type of analysis which is highly important. This has to do with language relations. The particular point to be stressed at this time is that there must be the ability to analyze these relations. The teacher of a foreign language speaks of this work as construction work. It is not believed that the child can proceed upon any such technical basis in learning to read, but he can use analysis in phrasing, inflection, pitch of voice, and other elements of this type. Such an analysis is fundamental to all comprehension, and should be taught and emphasized as the language used in the reading becomes more and more complex.

CHAPTER VIII

RATE OF VOCALIZATION

An important phase of vocalization is the rate at which it roceeds. Such a rate has in it at least two elements: the nuscular reactions, and, on the mental side, the process of in-erpretation. Both of these factors enter into reading rates. n oral reader who proceeds smoothly and easily in his reading s able to do so because the muscles of his vocal apparatus espond quickly and readily to the stimuli and because he is ble to arrive at the meaning in an accurate and easy manner.

The separation of these two elements is a rather difficult atter. The problem has been attacked by the writer (14) in e following manner: first, the subject was allowed to pro-ounce thirty easy and familiar words three times. The words ere arranged in a different order each time. Second, the bject was asked to count repeatedly from one to ten for thirty conds. The first test has in it both the muscular reaction me and interpretation, while the second test has the element interpretation reduced to a minimum.

The results show clearly that the counting rate is more rapid an the pronouncing rate. Some of the most rapid counters id not prove to be the most rapid readers, and those who unted slowly were not always the slowest readers. These sults indicate that the rate of reading is a complex affair d depends upon more than the mere rate of vocalization. n the other hand, in most cases, those who pronounced the st of words rapidly read rapidly, and those who pronounced e words most slowly were slow readers.

Table XV presents facts regarding the rate of counting for e several school grades. This table shows the percentage of children or adults in the various grades who have a rate of counting of five or more words per second. The absence of any uniformity in these results indicates that differences in rates of counting are individual matters and not subject to

TABLE XV

Showing Counting Rate According to School Grade

GRADE	PERCENTAGE
3	33
4	75
5	37
6	71
7	66
H. S.	90
C.	75

change through training. In counting there is a tendency to slur over words. This fact may contribute to certain of the differences in the table. The increase in rate of counting is not great enough to indicate that there is any large increase in the rate of articulation in the upper grades. It seems evident, therefore, that increasing familiarity with words is an important factor in producing the results in the pronunciation test. This increase from grade to grade is shown in Table XVI. The percentage column includes those who have a rate of pronouncing which is two or more words per second. Such data present a strong argument for familiarity with language forms

TABLE XVI

Showing Pronouncing Rate According to School Grade

GRADE	PERCENTAGE
3	11
4	25
5	50
6	71
7	44
H. S.	70
C.	100

If such familiarity reaches the stage where it is both rapid and accurate, one of the most important elements in the rate of reading is taken care of.

An important phase of this problem has to do with the determination of the time in the school experiences of the child when the rate of pronunciation first equals the counting rate. Judd (22) has presented data obtained by a method similar to the one just described to show that this period is near the fourth grade. These results indicate the time at which recognition overtakes vocalization. This is the point in the child's experience at which he needs a new method of interpretation, because the method used in oral reading is too slow. The more rapid method of interpretation is supplied by silent reading. The question is often asked by teachers as to when formal instruction in silent reading should begin. Judd's results answer this question satisfactorily. Precocious children and slow children might be given the counting and pronouncing tests in order to determine the time at which silent reading should begin in their particular cases. Such procedure seems advisable, because Judd's results are averages and will not apply to all cases.

The problem involved in the rate of vocalization has also been attacked by Cattell (5) from a little different standpoint. This investigator was interested in determining the lapse of time which must ensue after a word comes into the visual field before pronunciation begins. This is usually spoken of as the visual-vocal reaction time. In order to get accurate results for such periods of time, it is necessary to use complicated apparatus which allows the measurements to be made in thousandths of a second. The results obtained by Cattell showed rather marked individual differences; but since he did not correlate his results with reading rates, the interest which attaches to them at this time is general.

Some of his results are shown in Table XVII. The numbers in this table indicate time in thousandths seconds. That is, it took subject B 397 thousandths seconds to start the pronunciation of the word "bond" after it came into his visual field. Likewise it took Subject C 405 thousandths seconds to start the pronunciation of the same word. Another list of words used by Cattell includes words that are much longer than those as shown in Table XVII. These results show that it took Subject B fifty-two thousandths seconds longer on the average to recognize the long words than it did for him to recognize the short words. Likewise, it took Subject C forty-six thousandths seconds longer for the long words.

TABLE XVII

Showing Reaction Time for Various Words, by Cattell

WORD	SUBJECT B	SUBJECT C
Bond	397	405
Style	435	442
Fact	355	385
Light	394	414
House	367	388

Cattell divides the time required for the recognition of a word under these conditions into four different periods, as follows: (1) the latent period in the sense organ, (2) the transmission in the afferent nerve, (3) the transmission in the spinal cord and efferent nerve, and (4) the latent period in the muscle. A reaction time of 150 thousandths seconds he divides as follows: (1) 50 thousandths seconds for the transmission to and from the retina; (2) 5 to 10 thousandths seconds the latent period in the muscle; (3) 15 to 20 thousandths seconds latent period in the retina for the transmission of light reflected from the white surface; and (4) 75 thousandths seconds for the cerebral operations. It seems probable that there is involved in such reaction times a fundamental factor in reading rate. It is highly desirable that these experiments be repeated and the results correlated with rate of reading.

ʼay oɪ summary, there are individual differences in the which individual pupils vocalize. Two factors are con- in the process. One of these is the familiarity with ;e forms, and another is the rate at which the nervous ıscular systems function. The first seems amenable to ;, while the second is probably a fundamental character- ıich can be changed but little. The time in the school ıces of the child when the rate of vocalization and the counting becomes equal is important as indicating the at which silent reading should be introduced into the ; of the child.

CHAPTER IX

VOCALIZATION DURING SILENT READING

It is common knowledge that many pupils make use of vocal movements during silent reading. In the case of beginners these movements are very apparent — so much so, in fact, that their reading in many cases is a kind of silent oral-reading. In such reading most of the vocal movements of oral reading are present, and accompanying these motor processes there may be certain speech sounds. These sounds are usually in the nature of whispers rather than sounds produced by the vocal cords. The type of reading just described is due largely to the fact that the first reading of the child is oral. As a result, the methods of this type of reading are carried over into the early silent reading. Though these conditions usually prevail among beginning readers only, yet occasionally more experienced children read in a manner similar to that of the primary child. Such children present a problem to the teacher. If these movements are a fundamental phase of their reading process, then it seems necessary to allow them to continue their vocal movements during silent reading; but if such movements are merely a habit carried over from their earlier experiences in reading, then it seems essential that this motor element be reduced to a minimum. This problem derives its importance from the fact that silent reading which carries with it vocal movements in any large degree is relatively slow.

The study of the problem will be approached from two different standpoints. These are as follows: (1) The presence of vocal movements in silent reading, and (2) the purpose or function of such movements.

The Presence of Vocalization in Silent Reading. There are *many* degrees in which these movements may be present. In some instances they are hardly perceptible to an observer. In cases of this kind all sounds have disappeared and the movements are very much slurred and abbreviated. Only one or two slight movements are made for each word. In reading of this type only certain of the speech organs are used. There are pupils who seem to move only the lips during silent reading, while others seem to employ movements only at the base of the tongue, and still others in whom the movements are apparent only in the larynx. In other readers there are no movements apparent to the observer. In some cases a very slight movement may correspond to a phrase or a whole sentence. Some persons are very conscious of these slight movements, while others maintain that they are entirely free from all traces of such movements. Whether any person reaches the place where all traces of movements disappear in his silent reading is a very much mooted question.

Vocal movements are very complex and, as a result, are very difficult to study in any experimental way. Since such movements may be in the larynx, or in the tip or the base of the tongue, or in the palate, or in other portions of the vocal organs, it is almost impossible to employ any form of apparatus which will record such movements in any adequate way. To add to these difficulties, certain readers maintain that they do not have a real movement of the parts, but only a tendency toward movement. If such be true, the difficulties of devising apparatus to detect such tendencies are very apparent.

In spite of these difficulties some authorities have attacked the problem by employing certain types of apparatus. Curtis (8) procured objective records of the movements of the larynx by placing a sensitive tambour over this organ. The movements were then recorded upon a moving drum which carried smoked paper. In fifteen out of twenty cases he found movement, while in the remaining five cases the results were negative. This means doubtless that the apparatus was not sufficiently refined to produce results in all cases. But even if there were no movements present in the larynx, it must be remembered that it is entirely possible that there were movements in other parts of the vocal apparatus. Courten (7) experimented with the movements of the tongue by means of a Rousslet exploratory bulb. The movements of the tongue compressed a bulb which was connected to a tambour by means of a rubber tube. The pointer of the tambour recorded the movements upon a moving drum. This author reports that movements were present in every case.

Hansen and Lehman (15) found that if a person thought intently of a word there was an audible whisper which could be heard if conditions were made favorable by means of sound reflectors. Reed (30) used apparatus to register tongue movements. He proceeded upon the theory that if any speech movements were present tongue movements would form a part of them. The apparatus was so arranged that breathing movements were recorded along with the vocal movements. Methods were found by means of which the breathing movements and the speech movements could be separated. His conclusion is that the presence of vocal movements in reading constitutes an individual, rather than a universal, trait. He also calls attention to the fact that usually introspections concerning the presence or absence of the motor elements of reading are confirmed by the objective data.

Other authors have attacked the problem by means of observation. In this way Quantz (29) found movements of the speaking parts to be universal in the early reading of children. He found also that such movements decreased with practic and usually disappeared in the rapid and more intelligen readers. It is his idea that lip movement in silent reading is no acquired, but that it is a reflex action the physical tendency t which is inherited. This would mean, then, that readin without lip movement has to be learned. The writer (14) ha also attacked the problem from the standpoint of observatio *as seen in* Table XVIII. The left-hand column indicates the va us school grades. In the second column various readers are inated by different numbers, and in the third column different

TABLE XVIII

wing Amount of Vocalization in Silent Reading through Successive School Grades

ade	Subject	Amount of Vocalization	Range in Silent Rate	Grade	Subject	Amount of Vocalization	Range in Silent Rate
3	1	**	3.1– .3	7	33	*	4.1–2.5
	2	0	4.5–2.5		34	0	3.4–1.3
	3	**	3.6–2.1		35	0	3.0–1.9
	4	**	4.1–2.2		36	*	3.4–1.9
	5	**	1.9–1.5		37	*	4.1–1.6
	6	0	3.3–1.9		38	**	5.9–2.0
	7	*	5.8–2.5		39	0	5.9–2.8
	8	**	1.9–0.8		40	*	4.6–2.4
	9	***	2.5–1.9		41	*	3.5–2.1
4	10	**	3.1–1.7	H. S.	42	0	4.9–2.5
	11	**	2.7–1.6		43	0	6.5–3.5
	12	*	3.0–1.6		44	*	4.7–2.0
	13	*	2.4–1.3		45	*	3.9–2.6
	14	**	3.4–1.5		46	*	4.6–1.9
	15	*	2.2–1.0		47	0	6.5–3.3
	16	**	2.9–0.9		48	0	4.1–1.8
	17	**	2.0–1.2		49	0	3.1–1.4
5	18	*	3.1–1.7		50	0	5.1–2.1
	19	*	2.9–1.2		51	0	4.6–2.1
	20	0	3.1–1.2	C.	52	*	8.2–3.8
	21	*	3.5–1.5		53	0	8.2–3.1
	22	0	2.3–0.8		54	0	8.2–3.4
	23	*	3.8–1.4		55	0	4.1–2.4
	24	*	4.1–2.1		56	*	6.8–3.3
	25	0	3.0–1.2		57	0	10.0–3.6
	26	0	2.9–0.8		58	*	6.8–3.1
	27	*	5.3–1.8		59	0	6.0–2.8
	28	**	3.7–1.3				
	29	**	4.1–2.1				
	30	*	6.0–4.3				
	31	*	5.6–2.5				
	32	0	4.6–1.6				

ounts of vocalization noted during the silent reading of the ject is indicated. A *zero* in this column means that there was no movement perceptible; one asterisk indicates a slight amount of movement present; two asterisks mean much movement; and three asterisks mean very much movement present. The fourth column in the table indicates the range in the rate of silent reading for selections of varying difficulty. From this table it is clear that vocalization was observed in a large percentage of the cases. The fact that it was not observed does not mean that it was absent in the other cases.

In addition to the methods already noted Stricker (35) used the method of introspection. He questioned one hundred persons with respect to their motor experiences when they thought of certain letters. He discovered only one person who did not report a motor accompaniment of such mental activity. Huey (17) also used the method of introspection and found among thirty students that the large majority reported inner speech in some form to be a part of their ordinary reading. The term "inner speech" which is used by Huey in this connection is a broader term than vocalization. Therefore it should not be inferred that vocalization was present in each of the thirty cases reported by Huey.

This brief survey of the literature shows the results to be somewhat conflicting. However, it seems safe to conclude that vocalization in some degree occurs in the reading of most persons. The fact that this motor activity is present is not usually accepted as proving that it has an important function to perform in the reading act. This phase of the problem remains to be discussed.

The Function of Vocalization Movements in Silent Reading. The problem suggested here is concerned with the relation which this motor activity bears to interpretation. If it is a fundamental and necessary phase of the method by which meaning is obtained, then its presence is legitimate; but if there are methods of arriving at meaning which do not involve vocalization and which are more efficient, then this motor method of interpretation should be eliminated if possible. Study of this roblem has been attempted by some investigators by means f experimentation.

One method of attacking it consists in having the subjects mploy their vocal muscles in some other way while the reading rocess is going on. If it is found that reading can proceed in xperiments of this type, then certainly vocal movements are ot necessary in the reading process. The difficulty lies in mploying the vocal apparatus so that no movements which elong to the reading process will appear along with the other ovements. In performing an experiment of this type, Secor 33) had his subjects whistle while they were reading. The ethod was later changed because it was thought that this procedure allowed certain of the movements in reading to take place. e employed a second plan in which he required his subjects to epeat a letter over and over during the reading. Secor thought hat the second method eliminated all possibility of reading ovements in the vocal organs, but other writers pointed out e possibilities of movements under these conditions. As a sult his findings are not considered as final. Secor's con-usion is that it is possible for the reading process to proceed nder the conditions of his experiments with little or no inter-rence from the imposed movements of the vocal apparatus.

Pintner (28) varied Secor's method by having his subjects unt while they read. He tested the rate of reading before his bjects began the experimental work and followed this by aining in counting so that the process became automatic. fter training in reading while counting, the rate of reading as found to have increased in a marked degree. This increase, cording to Pintner, was due to the fact that the reading process as not encumbered by the movements of vocalization which ually accompany it. The experiment would have been much etter if a control group had been used. Such a group should ave had the same training in reading as the experimental group ithout the counting. It is understood now that for certain pupils ly a little training is necessary in order to increase their rate of reading, and it may be that the control group would have shown a marked increase in their rate.

Reed (30) varied his method in the latter part of his investigation to determine the function of inner speech. He thinks that it plays no important part in reading.

The general conclusion to be reached from these experiments is that vocalization does not have a vital and necessary part in the reading process. However, it can hardly be claimed that the control in these investigations is absolute, and for this reason the results should not be taken as final.

Other types of evidence on the same problem may now be given. Quantz (29) and Abell (1) have both emphasized the retarding influence of vocal movements upon the rate of reading. Each of these investigators found in his work that the slow reader was nearly always the one who used lip movements. Huey (17) has stated that vocalization is a thing which should be eliminated from reading, and Dearborn (9) is of the opinion that the attention could grasp more if it were not held back by the movements of vocalization.

One of the most interesting bits of evidence upon this problem has been contributed by Collins (6). In his study of abnormal cases in which the ability to read had been lost he found some patients who had no inner speech and yet they had the ability to read. It is very difficult to show conclusively that such persons have lost inner speech entirely; but if Collins' methods are accepted, his results indicate that inner speech is not essential to the reading process.

Reference may be made again in this connection to Table XVIII. From these data it is apparent that the greatest amount of vocalization is present in the third and fourth grades. This corresponds to the observations of Quantz, and must indicate the very great influence which oral language and oral reading have upon the early silent reading of children. In a large majority of the cases recorded in the table a high degree of vocalization is correlated with slow reading. This evidently means that such readers have a kind of one to one correspondence between the vocalization movements and the various sounds which make up the different words. Under such conditions interpretation proceeds slowly. The reverse of the above statement is not true, *i.e.*, those who have a slight degree of movement present are not always rapid readers. Evidently, there are factors which determine the rate of reading other than the amount of vocalization.

Some rapid readers are to be noted who have a slight degree of movement. This indicates that such readers slur and abridge these movements very much. In these cases, the process of reading is not retarded and held back by the movements, but the movements are so modified that they keep pace with the process of interpretation.

Other points noted in connection with this same group of readers, but not shown in the table, were that a difficult passage might provoke vocalization movements, and that certain readers used such movements at the beginning of any new passage. In the first instance it is doubtless true that vocalization helps these pupils in their interpretation, and it is thus made use of when interpretation is difficult. The second instance may be due to much the same sort of thing, except that the pupil employs the vocal movements only as an aid in getting started in a selection. After interpretation is once begun and the selection "felt out," such movements are no longer necessary.

Certain views of the problem based upon introspection are also of interest. As has been suggested, Stricker (35) supported the theory that vocalization is a fundamental phase of reading. It was his idea that reading could not proceed without some of the vocal movements found in speech. He based his argument upon the fact that mental activity is distinctly motor in its nature. To him, all thought was conditioned by vocal movements. This view was opposed by Stumpf (36). He pointed out that, if the view of Stricker was correct, then all differences in tones which it is possible to distinguish would depend upon differences in vocal movements. His contention was that many distinctions of this nature which it is possible to make are entirely too fine to be the result of differences in movements. Paulham (27) also disagreed with Stricker. He thought that the fact that Stricker was looking for the motor elements in his mental activity brought them into being, and that this accounted for their presence. These differences of opinion may be due to individual differences in the mental activity of these men. It is possible that for Stricker vocal movements were necessary, while Stumpf used other methods of interpretation.

One other theory of the question should be presented. This view calls attention to the fact that language and mental activity have been developed together and that each has been acquired in a large measure as a motor process. This means that the child approaches his first reading with certain characteristics which tend to give prominence to motor activities. In addition to this, most of his experiences up to the time of his introduction to reading have been predominantly motor. It is also true that before children speak they express themselves by various kinds of movements. Again, the early experiences of the child with language always involve movements of the vocal apparatus. In addition to these vocal movements there may be gestures and other types of movements accompanying the oral language. During this period his responses to most of the stimuli which reach his nervous system are essentially motor. He has not reached the place in his development where reflection and other higher types of mental activity replace the earlier types of responses. One reason for the presence of vocal movements in the reading of many pupils is now apparent. Such a form of behavior corresponds with their usual methods of response in their early development. It is only a phase of a type of response which they made earlier to all stimuli. With such conditions prevailing when the child is first introduced to reading, this method of response may easily be retained in his later reading experiences, In conclusion, it must be admitted that the real value of the motor accompaniments of the reading process is in doubt. It seems clear, however, that such movements in any large degree have no place in the reading activity, except in the case of a very few pupils. Reading which involves a large amount of motor activity may safely be characterized as an easygoing type of activity which has been developed by the reader because he has followed the line of least resistance. Pupils who read in such a manner could by practice and effort reduce to a minimum the vocal accompaniments of their reading, and in this way increase their efficiency. It is clear, then, from this entire discussion that the school is confronted with a definite problem. Every child begins his reading by employing his vocal apparatus in a degree which is not necessary in well-developed reading habits. It is the problem of the teacher to enable her pupils, by training, to proceed in their reading without these vocal activities.

CHAPTER X

BREATHING IN RELATION TO ORAL READING

It is well understood that oral reading is made up of a number of sounds which are produced by a flow of the breath. In this flow of the breath accurately established control is necessary in order that pauses and other phases of expression emphasis may be made. Such control has been emphasized in a large degree by public speaking teachers and vocalists as a phase of their methods of training, but very few elementary school teachers place any stress upon this element in the reading process. This is probably due to the fact that oral reading has been taught in a large degree as a kind of check upon comprehension. None of the finer points in oral reading have been of interest, because the prime purpose of the teacher has been to give the child a technique by means of which he can arrive at meaning, and since this is the case many elements of oral reading need not be emphasized.

It may be well to call attention at this place to the growing demand for a greater emphasis upon silent reading. This means, without doubt, that the amount of oral reading in our schools is to be very much reduced. In fact, schools may be found now where oral reading has been almost entirely abandoned and silent reading substituted. If oral reading is to remain in the curriculum and is to receive adequate attention it must be put upon a different basis from that upon which it now is. Evidently one opportunity for oral reading lies in the field of expression. The need for training in expression in the case of most children is only too apparent. They are inaccurate and careless in what they say and in the manner of expression. In many cases their voices are pitched high and have a distinct nasal quality. If this phase of language is to be modified, the modification must come through the public schools, and oral reading seems the proper avenue. It is the purpose, then, of this chapter to discuss breathing in its relation to those phases of oral reading which are concerned with expression.

For those who have never done so, it is very interesting to watch the breathing movements of children as they read. One may read with a series of short gasps; another may begin by filling the lungs full of air in such a manner as to raise the shoulder; while yet another may continue to read until his breath seems entirely exhausted. By such observation it is often possible to discover those children for whom the control of the breath presents a problem.

However, if progress is to be made in the study of such a problem, other methods of securing data must be used. A plan employed by the writer (14) will be described briefly. In addition to the tambour and moving drum mentioned in connection with the researches upon vocalization, experiments upon breathing necessitate the use of a pneumograph. Such an instrument may be placed upon any part of the thoracic cavity. A non-elastic cord goes around the body and is attached to the rubber membrane of a modified tambour, which is the essential part of the pneumograph. The movements of inspiration and expiration tend to change the density of the air in this tambour. This change of density results in a movement of the rubber membrane of a second tambour, which is attached to the first by means of a rubber tube. Attached to this second tambour is a lever which rises and falls with the movements of the rubber membrane upon it. The movements of this lever are recorded on a moving drum which carries smoked paper. A time line is made by another pointer which is moved up and down every fifth of a second. Such a time line is useful in determining the time length of the various movements.

In conducting experiments of this type it is customary to allow the child to read for a period of time before any record is taken. After the child is thoroughly at ease he may be allowed to sit quietly for a short time so that a record may be taken of the normal breathing. Without discontinuing the record, the child may be told to read so that the change from the normal breathing to the breathing as found in reading may be noted.

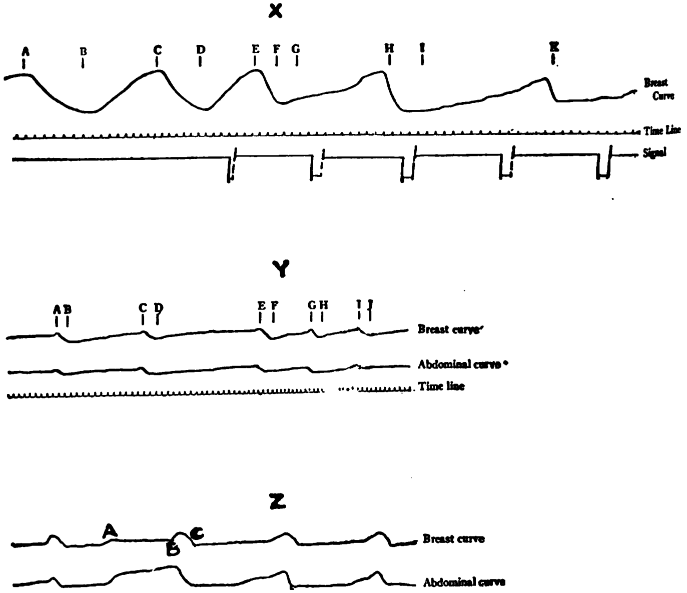


FIG. 5

Showing Different Forms of Breathing Curves

This change is to be seen in the curves shown in Figure 5. In the curve marked *X*, that portion from *A* to *F* represents normal breathing. At *F* the child was told to read and from that point the form of the curve is entirely changed. In that part of the curve which represents the normal breathing, the distance from *B* to *C* and from *D* to *E* represents the expiration movement, while the distance from *A* to *B* and from *C* to *D* represents the inspiration movement. This part of the curve is slightly flattened at *A*, *B*, *C*, etc. Such a fact indicates that there is a short time between expiration and inspiration when no movement is made. If a perpendicular line is dropped from *A*, *B*, *C*, etc., to the time line it is possible to determine the length of the different stages of the breathing movements. In this way it will be seen that the inspiration movement from *A* to *B* requires about six-fifths seconds while the expiration movements shown from *B* to *C* requires about nine-fifths seconds.

If a tangent is drawn to the curve at *A*, and a perpendicular is drawn to this tangent at the point of tangency so as to intersect a second tangent at *B* drawn parallel to the first, it is possible to determine the height of the breathing curve. The height of such curves is an index of the depth of breathing. The depth may be greater or less than that shown.

In that part of the curve following *F* where the command to read was given it will be seen that the shape of the curve is very different from that of the earlier part. The inspiration periods *H* to *I* and *K* to *L* have been shortened, and the expiration periods from *F* to *H* and *I* to *K* have been much lengthened. The depth has been slightly decreased and the expiration movement has changed into the inspiration period immediately as shown at *F* and *I*. In other words, the breath was not held as was indicated at *A* and *C* in the same figure. This form of curve indicates that the reader takes in a quick breath and then conserves it or allows it to pass through the vocal cords slowly.

The study of a number of children and adults by the writer has shown two typical forms of breathing among readers. In Figure 5, curves marked *Y* and *Z* show these different forms of breathing. In each of these figures there are two curves. The upper one is made by the movements of the abdomen. In *Y* it should be noted that the two curves are similar. In fact so much are they alike that they could be interchanged. This type of movement indicates an inward and outward movement of the walls of the thorax in both parts. It is also true that the amount of movement in the lower part of the thorax is no greater than that in the upper part. The record shown is that of an excellent oral reader in the sixth grade and doubtless the perfect control seen in this curve is of assistance to him in his reading.

In *Z* there is found a type of breathing which is regular in its nature, but a very great difference exists between the curve made by the movements of the upper thorax and that made by the abdominal region. The abdominal curve is similar to those considered in *Y;* but in the breast curve the record at *A* proceeds along a nearly horizontal line, which would indicate little movement of the upper thoracic walls. At *B* there is a sudden rise in the curve, which indicates a sudden collapse of the thoracic region. Almost immediately the lungs are filled, as indicated by the downward movement of the curve at *C.* Such breathing is evidently controlled by the diaphragm. As the diaphragm moves upward and forces the air out, the walls of the upper thoracic region remain stationary. When the diaphragm has moved upward as far as possible, it then starts downward; and instead of the walls remaining stationary during this part of the movement, they first collapse and are then forced outward by the air coming into the lungs. Unfortunately there are no breathing records of trained speakers or readers at hand, but it seems possible that this type of breathing corresponds closely to the abdominal breathing stressed by many teachers of public speaking and vocal music. This curve is the record of a seventh-grade boy who was a poor oral reader. The general form of the curve might lead to the conclusion that the reading was done by an expert, and we are forced to believe that the difficulty of such a reader is more fundamental than the breathing coördinations.

Results studied so far should be considered as typical. It is not to be understood that all curves conform to these types. In fact, there are very great variations in the regularity, form, depth, and every other phase of the curves. There seems to be a slight tendency for girls to show greater regularity in the form of curves than for boys. The greatest irregularities found are among women. Some of the best records from the standpoint of regularity, depth, etc., have been found among the men.

A very important factor in regard to breathing is the length of the expiration period. It is during this part of the breathing act that the reading is done. If the expirations are short, it makes the reading sound jerky; while if they are too long, it gives the hearer the impression that the reader is "running down." The length of this phase of the breathing act must vary with the material read, the inflection, force, and other factors which influence the reading. Evidently one of the important factors in developing this type of coördination is the length of the expiration period.

Another point connected with breathing is the relation of the inspiration periods to sense pauses, punctuation marks, etc. Results upon this problem show that there is very little relation between the two elements. This means that a child does not look ahead and determine in any fashion the points at which he should make inspirations, but depends entirely upon the fact that he is out of breath at certain places. Under such conditions the points for inspiration may be or may not be at a sense pause or a punctuation mark. These facts indicate clearly enough that for most children articulation and oral expression are two independent processes. Respiration, which is a part of the physiological process of articulation, may proceed in a way to be of direct assistance in expression or it may go on in a way which gives every evidence that control and adjustment are lacking. In the first case the demands of emphasis and expression are met through pauses dictated by the sense of the passage rather than by respiration. In the latter case the breathing pauses are probably produced by nervousness or sporadic nervous impulses, rather than by the sense of the passage read or by the ordinary laws of respiration. In conclusion, breathing is an organic process which is closely related to reading. The methods of control are usually left to the child's own devices, and as a result many different types of control are to be found. Without doubt this phase of oral reading should receive more attention at the hands of teachers.

CHAPTER XI

EYE-MOVEMENTS AND EXTRANEOUS MOVEMENTS IN THEIR RELATION TO READING ABILITY: DIAGNOSIS BASED UPON A STUDY OF THE MOTOR ELEMENTS IN THE READING PROCESS

This chapter will concern itself first with eye-movements. Eye-movements accompany all reading which proceeds by means of visual perception. The coördinations which are involved in the movements of the eyes as they adjust themselves to various situations are developed very early in the life of the child. As a result the part which the eye plays in the reading of both children and adults seldom comes into the consciousness of the reader. Therefore, most teachers of reading have failed to see any relation between reading ability and eye-movements, and have disregarded this important phase of the reading problem. Such a lack of interest is also due to the fact that most of the investigations in this field have been made by men who cared little about the educational bearing of the problem. Recently this phase of reading has been attacked by those whose interest in it grows out of its educational significance, and as these results are more clearly understood it may be expected that reading teachers will lay greater stress upon such investigations.

THE RELATION BETWEEN EYE-MOVEMENTS AND READING ABILITY

One approach to this problem is through the discussions of investigators in this field. One such treatment of the problem by Dearborn (9) may be quoted, as follows:

> These movements are not only subject to the influence of the direction of thought as words and phrases are read and assimilated, but they are also

directly concerned in the sensory processes of perception. The peculiar jerky and interrupted form of movement which is more exactly a series of alternate pauses and movements is due in part both to the requirements of appreciation and assimilation and to the physiological limitations of perception. This two-fold relation of these movements with the control activities on the one hand, and on the other hand as the necessary accessory to a peripheral organ of sensation gives them an intermediary position between sensation and recognition and between thought and motor expressions which is of particular interest for the cues or indices which study of them may give of some of the workings of the mind.

Another approach to the problem is gained by making observations of eye-movements while reading is in progress. One method by which this plan may be used is shown in Figure 6. *A* is the observer and *B* the subject. The subject reads the material at his left, while the observer gives attention to the movements of the subject's eyes in the mirror *M*. In this way it may be seen that the movements are not continuous but are in the nature of jerks and pauses. After some practice in such observations, it is possible to count with a fair degree of accuracy the pauses in any one line. It will also be observed that the return movement of the eye from the end of the line to the beginning of the next line is in the nature of a long sweep. Further, it may be noted by the same method that most of the movements in any one line are in a forward direction, but that a few of the movements may be in a backward direction. Such observations stand in direct contrast to popular opinion in regard to such matters. Most readers think that they read with a continuous movement of the eyes and that they read entire blocks of material or an entire page at a time rather than line by line.

After such preliminary observation, probably the simplest way in which to convince oneself of the importance of eye-movements in their relation to reading ability is to think of them in terms of perception. The movements of the eye across the page are of such a nature as to allow a series of short peeps at the material. In this way, eye-movements reduce reading to a series of short exposures. It is apparent that the pupil who is able to use the fewest and shortest peeps or exposures is the most efficient reader. The conditions and the training which enable the pupil to become efficient in this procedure are important problems which confront every teacher.

The problems connected with eye-movements are many and varied. The most obvious of these problems are the number and the length of both the forward and backward movements during the reading and the location of the pauses within the reading matter. When such data have been determined, further problems immediately arise as to the causes which lead to a very small or a large number of pauses, the causes which lead to exceedingly long or short pauses, the effect which training has upon such practices, and finally the effect which would come from allowing children to have this problem before them in a conscious way.

Methods of Studying Eye-movements. The simplest method of dealing with eye-movements is to observe them by means of a mirror, or by means of a telescope. The mirror method has been made the basis of an extensive investigation by Landolt (25). Later the same method was used by Erdmann and Dodge (12). Hendricks (16) has also reported results from examining a few children by the mirror method, and a special form of mirror for such observations has been devised by Freeman (13). Barnes (4) has reported some data secured by means of a telescope. These methods give only a limited amount of data. Only rough estimates can be made concerning the length of the various pauses or the location of them within the reading matter. For this reason, their use was discontinued as soon as better methods were devised. However, the mirror method is without doubt the best method to be used by teachers and children in the schoolroom.

A second method which has been used for the study of eye-movements may be spoken of as the acoustic method. This procedure was used by Lamare (24) and Javal (19). Such a plan requires the attachment of a delicate microphone to the eyelid. In this manner the slight sounds which accompany the contraction of the muscles when the eye moves may be heard. This method gives no more data than does the mirror method, and for this reason it has been used but little.

The third method may be referred to as the after-image method. This was first used by Volkmann (38) and later by Lamansky (23). It involved the flashing of a ray of light into the eye at regular intervals through the perforations of a rotating disk. The subject was required to count the number of after-images produced during a certain movement of the pencil of light. Dodge (11) used a variation of this method in some of his work. He required his subjects to look intently at a small wedge-shaped illuminated body until there resulted a distinct after-image. The subject then read a passage and noted the pauses of the after-image as the reading progressed. A slightly modified form of Dodge's plan has been used by Barnes (4). Any form of this method is open to very serious criticism because it depends on memory, because the after-*image* is a constant distraction, and because the data procured

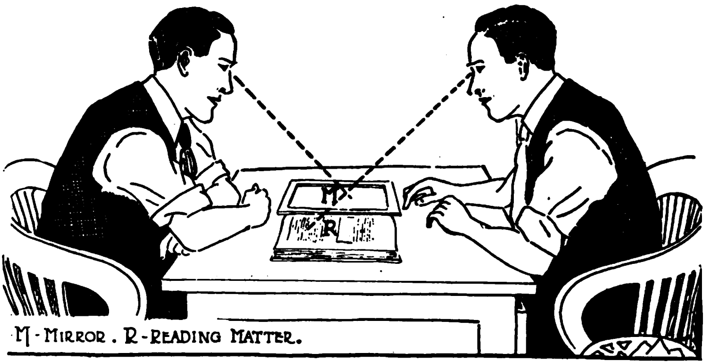

M
R
M - MIRROR . R - READING MATTER.

FIG. 6

Showing Method of Observing Eye-movements by it are limited. For these reasons it has never had general use.

The fourth method used for the study of the problem at hand was devised by Huey (18). This method requires that a small plaster-of-Paris cup be attached to the cornea of the eye. To this small cup was attached a delicate string. This ran over a small pulley and was then attached to a pointer. Any movement of the eye moved the pointer and these movements were recorded upon a moving drum. This method was first suggested by Ahrens (2). His idea was that an ivory cup could be attached to the eye. This was found not to be practicable, and Delebarre (10) suggested a plaster-of-Paris cup. Huey perfected this suggestion.

Such a method may be successful in the laboratory with a few subjects, but the placing of the cup on the cornea precludes its use with any large number of people. It is clear, also, that it would be almost impossible to use such a method with children. For these reasons its use has been very much limited.

A fifth method, which can hardly be designated by a single word, was used by Schackwitz (31). It consisted in placing a delicate tambour against the wall of the eye. By this means the movements were recorded upon a moving drum.

The last method to be mentioned may be spoken of as the photographic method. The plan used by Judd (20 and 21) required the use of a moving picture camera. In order to have a point of reference for the interpretation of the records, this investigator placed a bit of china-white upon the cornea of the eye. This method is usually considered to be the most accurate of any that has been devised for the study of eye-movements, but the use of the china-white almost precludes its use with children.

The photographic method was also used by Dodge (11). His procedure consisted in reflecting a beam of light from the cornea of the eye into the lens of a camera. The beam of light was focused upon a moving plate. In this way a record of the movements of the eye was made. This method furnishes a definite objective record of the movements from which it is possible to determine the number of pauses per line. It is also possible, by introducing a timing device, to calculate the length of each pause, and then by superimposing the material read on the photographic record to determine with a high degree of accuracy the location of the pauses in the reading matter. These points, along with the fact that the method lends itself to use with children, has led to its use by more investigators than any other method. Certain defects of this plan of procedure have been pointed out by Judd, but these objections have been answered in part, if not entirely, by Dodge.

The work done by the authors thus far mentioned has been from the standpoint of general psychology. The first investigator to attack the problem from the educational standpoint was Dearborn (9). He used but very few children as subjects, but his work has stimulated others to choose their subjects from the schoolroom. After Dearborn's work comes that of Schmidt (34). This investigator modified the apparatus used by Dearborn so that it could be used more readily with children. He also replaced the falling plate upon which the photographic record was made by a moving film which allowed a record of more reading to be made. A further modification of the apparatus is the use of two photographic lenses instead of one. Such a change allowed a record to be made for each of the eyes. This author was the first to base his work upon the reading of children. The number of children used in his investigation was thirty-eight. The writer (14) has modified still further the apparatus used by Dearborn. Certain of these modifications make it much easier to deal with children, and others make it possible to study the eye-movements of oral reading in a way that had not been done before. This work was based upon the reading of children. Judd (22) has also reported some results which were procured by the method just described.

This brief summary is sufficient to indicate the general method which must be used if this important phase of the reading process is to be studied in detail. It should also be noted that it is only recently that this problem has been attacked by those interested in its educational aspects, and the data collected from the reading of children are limited. The remaining portion of the discussion will be devoted to the somewhat detailed description of the last method mentioned and a discussion of the results obtained by it. This method may be described briefly as the photographic method for recording eye-movements by means of the reflection of a beam of light from the eye.

Reflection of Light from the Eye. The first point to be mentioned in this connection is that the surface of the eye acts as a mirror when light falls upon it. An instance similar to this is the glare of a cat's eye at night. This glare is caused by the reflection of light from the animal's eye. A second fact is that the surface of the human eye is made up of the surfaces of two spheres of unequal size. One of these is the surface of the ball of the eye and the other is the cornea. The movement of the eye takes place about the center of the large sphere. Now if a beam of light is reflected from the cornea and the eye turns slightly upon the center of the large sphere, the angle of reflection for a ray of light coming from some fixed source is changed, and hence the reflected ray will move. Hence, if, during reading, the reflected beam is focused on a moving film, it is possible to record the changes in the direction of the reflected beam, and these changes are taken as an indication of the movements of the eye.

Source of Light. The source of light usually used in such work is an arc light such as was formerly used in street lighting. The complete apparatus for furnishing light is shown in Figure 7. The arc light is inclosed in the house *B*. *A* is a rheostat which allows a greater or less amount of current to pass through the arc, so that the intensity of the light may be varied. After leaving the arc, the light passes through the two lenses indicated by *C*. Between these lenses there is a tank filled with water which cools the light. The lenses at *C* bring the light to a focus at *E*. At this point there is placed a diaphragm with a small hole in it so that all marginal light is eliminated. After the light passes this point of focus it disperses again but another lens *G* is placed in its path at the proper distance so that from this point the light is composed of parallel rays. At *H* the light passes through a violet glass. This reduces the effect of the light upon the eye.

Attention should also be called to the tuning fork *F*. One prong of this is made to vibrate in the path of the light at the point of focus. This interruption of the light has the effect of making the record upon the film a series of dots instead of a continuous line. This is important, because if the time of the fork is known it is possible to determine the length of the various pauses in the eye-movement record by counting the dots and the spaces between them.

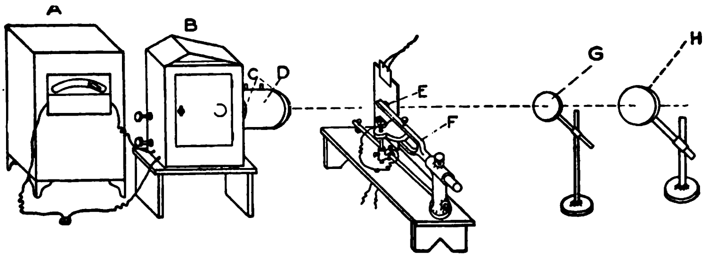


FIG. 7

The Light

The Camera. It is also necessary to have a camera devised for this particular problem. Such a camera is shown in Figure 8. After the light is reflected from the eyes, it passes into the photographic lenses at *D* and is focused upon a film encased at *E*. The film used is the same as that used in the ordinary camera and is moved by a motor on the floor below the camera but not shown in the figure. Various adjustments which are provided for on every good camera, such as the vertical and horizontal movement of the lenses, can be made by the rods indicated at *A* and *C*. These adjustments are made somewhat complicated in this case by the fact that there are two lenses and that these lenses must move independently. In order to facilitate focusing, the bellows *B* is placed at the back end of the camera.

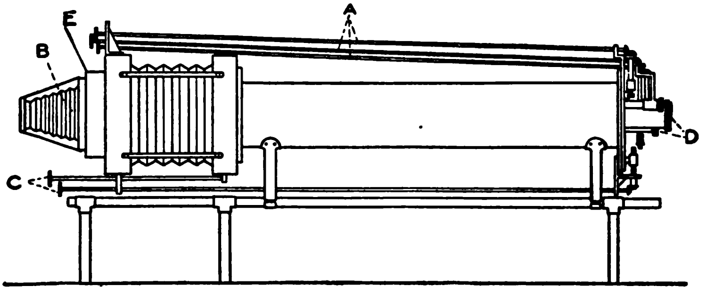


FIG. 8
The Camera

The Headrest. Another important part of the apparatus is the headrest. Casual observations show that many pupils move the head and shoulders while reading. These extraneous movements have little if any relation to the reading activity. Many of these movements are so gross as to make impossible an interpretation of the photographic records of the eye-movements. In some cases they may be sufficiently large to throw the beam of light entirely off the film. In order to control this element in the reading process, a headrest is used. Such a piece of apparatus is shown in Figure 9. When the subject is in position, the pads marked *A* come in contact with the cheek bone, and the head is encircled by the iron collar *B*. This collar is shown in a vertical position at *C*. The different pads which come in contact with four different points of the head can plainly be seen. The relations of the various parts of the entire apparatus are shown diagrammatically in Figure 10.

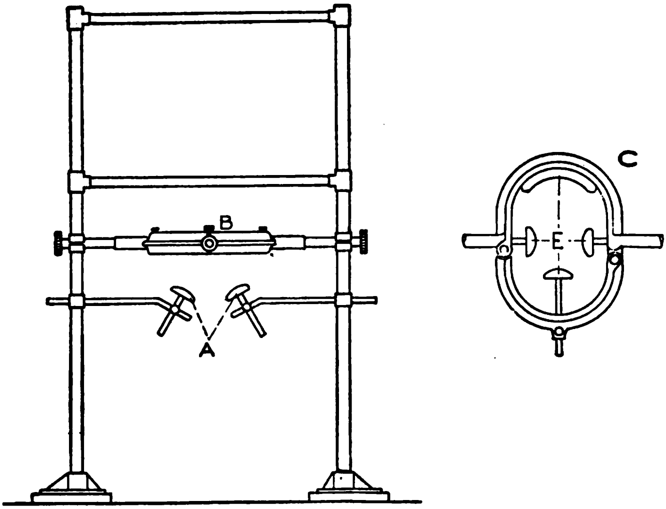


FIG. 9

The Headrest

Eye-movement Records. Figure 11 shows a number of records made by the technique just described. A study of record *A* may begin at *a*. This point is the end of a line, and the sweep of the eye to *b* brings it to the beginning of a new line. After the eye reaches the point *b* where it begins the reading of a new line it remains stationary for a short time. This stationary period of the eye is shown by the vertical line from *b* to *c;* that is, since the film is moving vertically, there is a vertical line made whenever the eye is still. From *c* the eye moves a short horizontal distance to *d* and remains stationary again for a period of time indicated by the line from *d* to *e*. This process is repeated until the point *f* is reached. Here, instead of the movement's being in a forward direction, it is backward toward the beginning of the line. Such movements are spoken of as regressive movements, and are probably due to the fact that the interpretation up to that point was not complete for some reason, and thus the eye was shifted backward in order that the first interpretation might be supplemented.

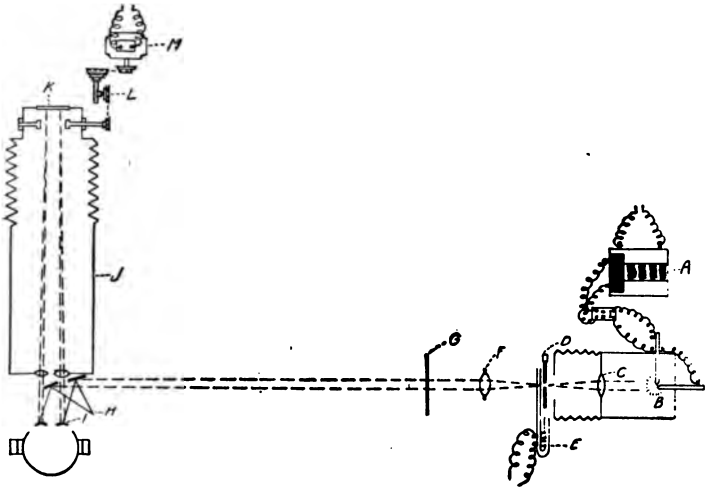


FIG. 10

Showing Relations of Parts of Photographic Apparatus

A rheostat
B arc
C condensing lenses
D diaphragm
E tuning fork
F condensing lenses
G purple glass
H mirrors
I eyes
J camera
K ground glass
L speed reducer
M motor

Record *c* is composed of dots. These dots are produced by the vibrations of the tuning fork. By counting them and the spaces between them it is possible to determine the length of time during which the eye remained stationary. This is highly important, because it may be thought of as the period of time which is required for interpretation to take place.

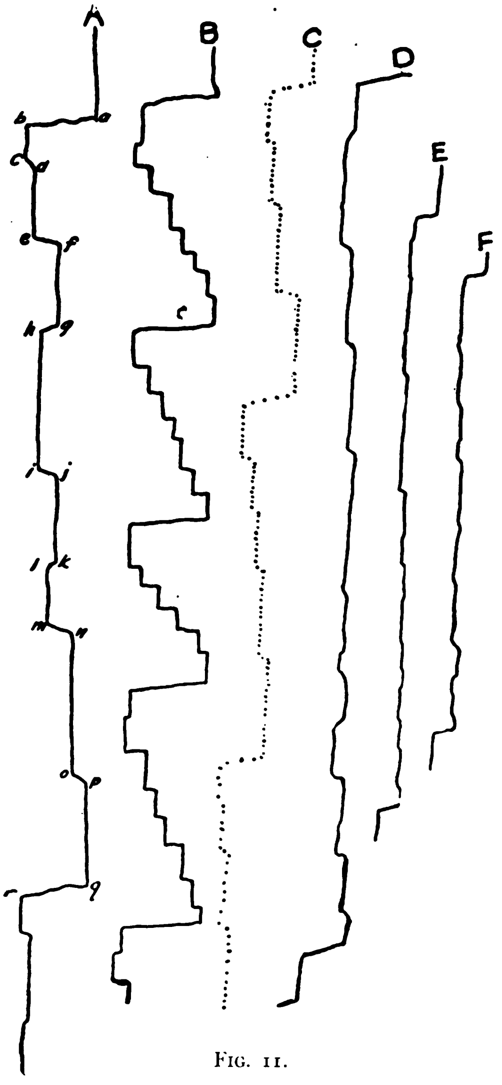


FIG. 11.

Showing Photographic Eye-movement Records Much Enlarged

A, Normal adult reading; *B*, Highly rhythmical adult reading; *C*, Form of recor from which time of various pauses may be determined; *D*, Record from very slo adult reading; *E* and *F*, records from slow and inaccurate readers in the sixth grad

This doubtless carries the discussion far enough to show that study of such records will furnish the following types of data: 1) the number of forward movements, (2) the number of regressive movements, (3) the length of the forward movements, and (4) the length of the regressive movements. In addition to this, it is possible to superimpose the photographic record upon the material read and so determine the various points in the reading matter where the eye pauses. In Table XIX data are given concerning the first four points. The total number of subjects represented here is less than fifty; hence the results cannot be taken as final. The lowest school grade is the third. The material read was different for each grade, but was selected so as to be within the ability of each grade.

The Forward Movements. It will be noted that there is a decrease in the number of pauses per line as the upper grades are reached. If more pupils had been used, it is highly probable that the irregularities would have disappeared in a measure. The decrease in the number of pauses means that there is an increase in the span of perception. This may come both from experience and from familiarity with language forms. Under these conditions interpretation must take place in larger units in the upper school grades than it does in the lower grades.

TABLE XIX

Data Concerning Eye-movement Records in Silent Reading

Grade	Average No. of Pauses per Line	Average Length of Pauses	Average Variation for Length of Pauses	Average No. of Regressive Movements	Average Length of Regressive Movements	Average Variation for Length of Regressive Movements
3	10.0	14.2	4.1	2.4	12.4	2.3
4	9.1	12.5	2.9	2.1	11.5	1.3
5	10.0	13.8	3.5	2.4	12.0	1.1
6	7.5	12.5	3.1	1.4	9.8	1.3
7	7.8	13.6	3.5	1.5	9.0	0.8
H. S.	6.4	11.5	2.5	0.8	5.6	0.2
C.	6.9	11.3	2.6	1.1	8.1	0.5

From this standpoint, it would seem that a well-taught child is one who is able to deal with reading material in large units.

From the table it will also be noted that the length of the pauses decreases as the upper grades are reached, and again it may be supposed that the irregularities would disappear in a measure if a larger number of subjects had been used. Such a decrease is doubtless due to experience and to familiarity with language forms. It may also be possible that maturity plays its part. This decrease shows that in the upper grades a certain unit of material can be interpreted in a shorter period of time than in the lower grades. From this standpoint, a well-taught child is one who has learned to deal with units of meaning in a minimum of time.

The above discussion has shown that the most efficient reader is one who deals with large units of material and who at the same time is able to bring about interpretation of such units in a minimum of time. However, the most rapid readers are not always those who make the fewest pauses per line nor those who make the shortest pauses. In other words, it seems possible to reduce the number of pauses per line, as well as their length, beyond the point where efficient reading is possible. By referring to the table again, it will be noted that the average variation for the length of the pauses also decreases through the grades. This means that the reading is more stable.

Regressive Movements. The column for the number of regressive movements shows that there is a decrease of such movements through the grades. To understand this, it is necessary to remember that every movement of the eyes forward is literally a leap into the dark. The causes which determine the location of the pauses of the eye in reading have not been thoroughly established; but apparently experience enables the reader to reduce the number of mistakes which are made in the location of the points for the pauses of the eyes, and as a result reading becomes more dependable and more stable. There is *some* evidence that mature and experienced readers use the regressive movement in an entirely different way. Such readers may use these movements as periods of organization. In such cases the reader rushes forward over the material and then makes a regressive movement in order to organize the meaning of the material which has been hastened over. In cases of this kind regressive movements represent a method of reading rather than failures in interpretation. Movements of this type can usually be identified by their length both in time and in space covered.

Further facts concerning regressive movements are shown in the last two columns of Table XIX. The next to the last column shows that there is a decrease in the length of the regressive movements through the various grades. This means that through training and experience the reader is able to make a quicker "recovery" when a regressive movement is necessary. The last column shows clearly that the reading of adults and high school students is much more stable than that of the lower grades. In all this discussion it must be remembered that there are many exceptions to these general rules. In fact, Schmidt says:

> The motor behavior of the eyes in reading differs in the cases of children from that of adults, not so much in numbers and duration of pauses, nor in steadiness and precision of fixation, but rather in frequency of refixation and the regularities affecting the number and the duration of pauses, refixations and average deviations being more in evidence in the case of the elementary and even the high school grades than in the case of adults. All of this goes to show, of course, that children develop at an early age a high degree of motor control but that their habits are as yet largely unformed.

Undoubtedly what this author says is true of the cases which he studied, but since his investigation other researches have shown that there are differences between adults and children as to the number and duration of pauses as well as to steadiness and precision of fixation.

Eye-movements for Oral Reading. Table XX gives data concerning eye-movements during oral reading. Here, again, there is a decrease in the number of pauses, length of pauses, etc., in the upper grades as compared with the lower grades. Such conditions grow out of the greater experience and training which those in the upper grades have had.

This table also shows that the number of pauses and the length of pauses, as well as the number of regressive movements and their length, are greater than in silent reading. This is due to the fact that the vocalization movements in oral reading do not allow the movements of the eyes to proceed at the same rate as in silent reading. In other words, the eyes, or better, the attention, has to mark time while the vocal movements are proceeding at a rate which is comparatively slow. This retarding of the movements of the eyes results in a greater number of pauses and in longer pauses than is true in silent reading. Therefore, the units by which oral reading proceeds are small as compared with those in silent reading, and the time taken for interpretation is unnecessarily lengthened. This can only mean that a large amount of training in oral reading makes for mental lethargy and for slow reading.

TABLE XX

Data Concerning Eye-movement Records in Oral Reading

Selection and Grade	Average No. of Pauses	Average Length of Pauses	Average Variation	Average No. of Regressive Movements	Average Length of Regressive Movements	Average Variation
4	13.3	14.4	3.5	3.2	13.1	3.1
5	9.3	13.7	3.9	2.1	13.5	1.9
6	9.0	13.0	5.4	3.0	12.5	4.0
7	10.6	13.1	4.2	2.7	11.7	1.5
H. S.	7.8	12.8	3.7	1.1	3.9	0.3
C.	8.8	12.9	3.4	1.6	7.8	1.6

THE LOCATION OF EYE-MOVEMENT PAUSES WITHIN READING MATERIAL

It is possible to superimpose the photographic records upon the selection read in a way which allows the points of fixation to be located. The location of the pauses made in reading a selection is shown in Figure 12. This reading was done by an excellent reader in the sixth grade. The first pause, as indicated by the digits above the vertical lines, was made at the second "o" in "portion." This is to the right of the beginning of the line, as usually happens in the case of the first pause; but this

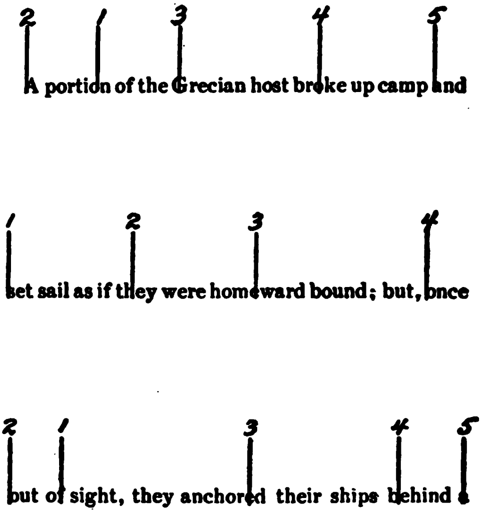

2 1 3 4 5
A portion of the Grecian host broke up camp and
1 2 3 4
set sail as if they were homeward bound; but, once
2 1 3 4 5
out of sight, they anchored their ships behind a

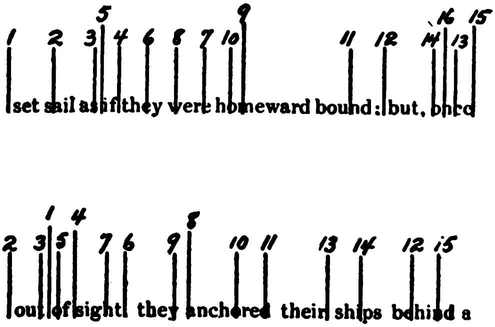
FIG. 12

Showing the Location of Eye-Movement Pauses in the Reading of a Rapid and Accurate Sixth-grade Reader

seems to be too far to the right, or, in other words, the reader has overreached himself and has to make a regressive movement back to the beginning of the line. From this point the fixations occur at 3, 4, and 5 in regular order. In line 2 the first fixation is made at the very beginning of the line. This is probably due to the series of small words at this place in the line. After this the pauses are made in regular order. In line three two facts are significant. First, the regressive movement at the beginning of the line is unusual; and second, the last pause, which is made at the extreme end of the line, does not follow ordinary procedure. The reading of this pupil was characterized by his teacher as being excellent on most occasions but at times too rapid. It will be seen that this description corresponds closely to the facts brought out by the eye-movement record. It may also be said that the reading of this pupil represents in a fairly accurate way the adult type of reader. It is characterized chiefly by few pauses. This means that recognition proceeds in phrases rather than small units. The regularity of the movements indicates that the entire reading process is under good control, and that interpretation proceeds in an easy and accurate fashion. Other children whose reading is of the adult type have been found in the second and third grades. The fact that such reading occurs in these early grades indicates clearly that many phases of the reading habit are fixed much earlier than was formerly supposed. Such facts make it imperative that the results of very early training in reading be better understood.

A very different type of reading is to be seen in Figure 13. This reading was done by a sixth-grade boy who was a poor reader. The reading of the first line begins at the very beginning of the line and proceeds in very small units to four, where there is a regressive movement. To explain a backward movement like five is difficult. It certainly is not due to the fact that the reading has proceeded in such large units that any word or words have been left out. It may be possible that interpretation is taking place in a very lame and halting manner so that it is necessary to go backward merely as a means of facilitating the interpretation of material which had already come within the field of perception. Attention should also be called to the movement from six to seven. Such a movement might easily be made by many average readers, but for this reader the amount of material covered seems to be too great and the regressive movement eight is made. Following this there are two pauses in the word "home" and then a leap to the latter

ırt of "bound." It would be very interesting to know whether
ıe two ideas "homeward bound" were included among those
hich made up the interpretation given for the passage by this
ader or whether these ideas were among the many which such
aders do not get. Another interpretation of such a move-
ent as that from ten to eleven is that it represents a faulty
'e-movement. In cases of this kind the reader may not be
ɔle to avail himself of the criteria which should determine



1 2 3 5 4 6 8 7 10 9 11 12 16 14 13 15
set sail as if they were homeward bound: but, once
1 4 2 3 5 7 6 8 9 10 11 13 14 12 15
out of sight they anchored their ships behind a

FIG. 13

Showing the Location of Eye-movement Pauses in the Reading of a Poor Sixth-grade Reader

ıere his eyes should stop. Again, the stimulus to the muscles
the eye may be such that too long a movement is made. The
st point to be noted in connection with line one is that the
ıal word seems to have been spelled out.

The second line does not represent anything very different
ɔm the first. Note again the very short units and the frequent
gressive movements. Such reading as this may be thought
as being on the level where the reading process begins. From
ch a standpoint, this pupil in the sixth grade is one who has
ver progressed from the level upon which his reading began.
reading of this type the units of recognition are very small.
most cases the reading proceeds word by word and in certain

places even letter by letter. For such pupils the span of perception is either very much limited or the training has not been such as to give the pupil the power to use his full span of recognition. It should be emphasized that the subject in this case was neither a dullard nor an exceedingly backward child. He was active and alert mentally, but for some reason he had never mastered reading.

The Location of the Pauses of the Eyes in Reading. The question involved is, Why does the eye stop at any particular point in printed material? Another question closely related to this one is, Why, in the case of many readers, is there so much variation in the distance between pauses?

A general answer to these questions is that apparently this phase of the reading process depends, almost entirely, upon the span of perception. If the span is large, the distance between the pauses is relatively large; whereas if the span is small, the distance between the pauses is also small. If this be true the pauses for any one reader should be almost the same distance apart when the material to be read is reasonably familiar and homogeneous in meaning. The lack of homogeneity in material makes the distance between pauses of the eyes a variable quantity in material which is familiar to the reader. There are many factors in printed language which have a tendency to decrease the span of perception while reading is in progress. At times during the reading process the span is relatively long; again it may shrink; and then again it may approach its normal length. This shrinking of the span apparently depends upon difficulties in interpretation. If material is difficult to interpret, it evidently does not lend itself to the usual method which the reader uses for grouping the parts into larger units; or it may be said that the various units cannot be associated easily.

To solve the problem of the location of the pauses, then, requires that those elements in the thought involved in the printed language which tend to break down the regular methods of association of the reader be determined. Dearborn (9) has called attention to the fact that short connective and non-substantive words, prepositional phrases, and dates require more pauses than do nouns, adjectives, and verbs. He thinks, also, that capital and dominating letters play their part in the location of pauses. It is his opinion, further, that punctuation marks prove an obstacle to some persons in their reading. Schmidt (34) thinks that there is a tendency on the part of readers to fixate an apperceptive unit in the central part of that unit. This method of procedure is facilitated, according to Schmidt, by the contributions of peripheral vision and context, and is interfered with by defective motor control, by short-lived motor habits, and by the demands of analysis. Schmidt holds, further, that the pauses do not seem to fall within any particular type of words. It is probably true that many other factors which are little understood, in addition to those already mentioned, have much to do with this problem.

The problem at hand has a very practical significance if it is viewed from the standpoint of the selection of material for beginners. In order that correct reading habits may be formed, it seems highly desirable that when the child begins reading he should have material, in so far as it is possible, which will allow the reading process to proceed in units of uniform length.

Another type of reading which is of interest is shown in Figure 14. Judd (22) has spoken of points such as that indicated under the brace as periods of confusion. Such periods are described by this author as follows:

> There must be a corresponding degree of mental effort during such a period of confusion. The continuity of thought must be seriously interrupted and the mechanical side of the reading process which consists in the effort to master words must occupy the center of attention.
>
> Even this description is probably too optimistic in its assumption that recognition results from wanderings of the eye. Wandering fixations represent an effort that does not in the end bring any meaning to the mind at all. In many cases confusion of the type here exhibited is followed by complete failure to recognize even the structure of the words.

This writer also distinguishes between periods of confusion and periods of analysis. In the reading of certain pupils periods are to be noted which resemble very much a period of confusion, but in some cases these readers have the means at hand for analyzing their difficulties; and although interpretation is delayed for the time, the situation is finally mastered and the reading proceeds. It may be that pauses 12 and 13 in Figure 13 represent this situation. If this be the case, complete recognition did not take place when the eye was focused at 12. As a result, a regressive movement to 13 was made. This movement resulted in complete interpretation, and the reading continued. A period of confusion would have meant more delay and other movements. The essential difference between a period of confusion and a period of analysis is that in analysis the reader has a method by which he can solve his difficulty while in the periods of confusion no such method appears.

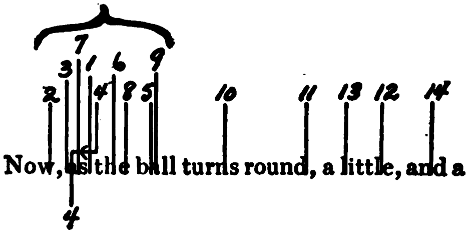


FIG. 14
Showing Period of Confusion

This discussion may be concluded by noting the pauses in oral reading, as seen in Figure 15. This is the record of an adult reader. It shows clearly enough that in oral reading recognition proceeds by words rather than phrases, as was noted in silent reading. This is in harmony with the earlier discussion concerning the methods of oral reading, and shows in an objective manner the dangers which may attend too great training in oral reading.

The Cumulative Effect of Eye-movements. Short-exposure experiments show that the effect of consecutive exposures is cumulative in its nature. If a sentence of five words is not perceived upon first exposure and is exposed again and again, the sentence will finally be recognized in its entirety. This shows that the effect of each exposure remains and the cumulative effect of these various exposures results finally in full recognition.

Another point to be recalled concerning such experiments is that recognition under conditions of this type exists on different levels. If a sentence of six words is exposed by the methods already described, three distinct levels of recognition can many times be distinguished. The first three words will be recognized so definitely that the subject is perfectly sure of them. In contrast to this, he may be very doubtful in his report about the next two words, but he is probably willing to hazard a guess upon them. Finally, he may report that there is another word further to the right, but that he has no idea as to what it is. Another way to indicate the differences which exist between these levels is to assign some definite value to each. In this

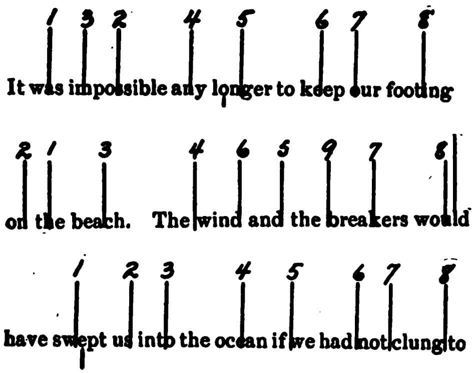

1 3 2 4 5 6 7 8
It was impossible any longer to keep our footing
2 1 3 4 6 5 9 7 8
on the beach. The wind and the breakers would
1 2 3 4 5 6 7 8
have swept us into the ocean if we had not clung to

FIG. 15

Showing Location of Eye-movement Pauses in Oral Reading case, the first level may be given the value of three, the second level the value of two, and the third the value of one.

The process of reading seems to involve each of the laws of perception just discussed. This will be understood by a study of Figure 16. The vertical lines indicate eye-movement pauses located by the methods already referred to. Perception may be thought of as taking place in the following manner: According to the law of perception above, the attention value at the point *A* would be three. To the right there is a portion of the line where an attention value of two may be assigned. This part may be considered as having its center at *B*. Again, another portion of a line further to the right would have an attention value of one assigned to it. The center of this part may be placed at *C*.

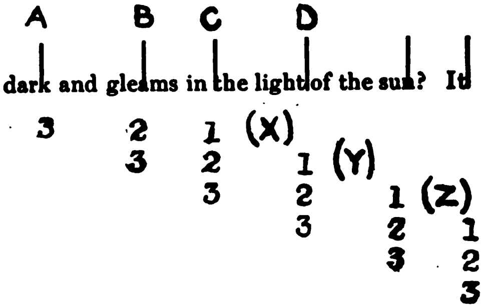


FIG. 16

Showing Effect of a Wide Span of Perception upon Interpretation

The row of digits designated by *X* in this figure represents the distribution of the attention when the eye is fixated at the point indicated by the line *A*. Now the eye shifts to *B*. The row of figures designated by *Y* represents the distribution of attention with the eye fixated at *B*. For the interpretation of the point *B* there is an attention value of three plus two. This would seem to require that the actual pause of the eye at *A* should be less than that at *B*. Dearborn has emphasized the fact that for experienced readers the first pause is longer than any other in the line. If the eye moves next to the point *C*, the row of digits designated by *Z* represents the distribution of the attention at this point. Now, for the point *C* there is an attention value of three plus two plus one. It would seem again that this pause should be shorter than the preceding one. Certain cases can be found where this is true, yet there seems to be no general rule to this effect. This is probably due to the fact that an attention value of one makes very little contribution to interpretation, and that it is almost impossible to get perfectly homogeneous reading material for experimental purposes.

If the above is a true description of the cumulative effects of eye-movements, it is easy to see the advantage of a long span of perception over one that is short. A reader endowed with a short span does not have the advantage of the cumulative effect which grows out of the successive eye-movement pauses. It is true that such results may occur in some slight degree where the span is short, but in such instances the cumulative effect would result in the recognition of syllables or individual words rather than the recognition of those units which allow interpretation to proceed rapidly.

The Overlapping of the Fields of Perception during Eye-movements. A wide span of perception also plays an important part in reading in that it allows an overlapping of the different

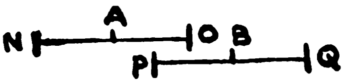


FIG. 17

Showing Probable Overlapping of the Fields of Perception during Reading

fields of perception as the eye moves along the line. If the eye is fixated at *A*, as shown in Figure 17, then the field of perception extends both to the right and to the left of this point, as from *N* to *O*. Now if the eye moves to *B*, the new field of perception may extend from *P* to *Q*. There would be an overlapping of the fields as indicated by the distance *P O*. It is clear that such overlapping is likely to occur if the span of perception is long rather than if it is short. Investigators seem to agree that there must be such an overlapping of the different fields of perception if reading is to be efficient. This is necessary in order that the different parts of the thought may be related and connected as the reading proceeds. On the other hand, if the fields do not overlap, words are left out and interpretation proceeds in disconnected units which can have but little, if any, meaning. It may be, however, that the experienced reader when dealing with familiar material is able to get the thought in a satisfactory manner, even if the fields of perception do not overlap. In fact, such a reader may deliberately use fixation points which do not allow any part of the fields of perception to coincide. The success of such reading depends upon the reader's having a definite point in mind for which he is looking or upon a general knowledge of the context. The process of skimming must proceed in a manner similar to this. Evidently it is necessary for children to develop such a control of the movements of their eyes that this overlapping will occur in the proper way. If the fields of perception overlap each other in too great a degree, there may be repetitions and confusion; while if the overlapping does not occur, omissions may result which will break the continuity of thought.

Differences between Good and Poor Readers. It is probable that the contrast between good and poor readers is set forth more clearly by means of the study of eye-movements than in any other way. In many cases the poor readers exhibit the following characteristics: (1) Many pauses; (2) very long pauses; (3) large number of regressive movements; (4) long regressive movements; and (5) periods of confusion. In those cases where the reading is poor because it is too rapid, the reader may reduce either the number of pauses or their length beyond the point where good reading is possible. Further than this, the location of pauses in poor reading indicates that peripheral vision and context play only a small part in such reading.

Another phase of this problem has to do with the time in the development of the child's reading ability when the characteristics of poor reading or of good reading first show themselves. In so far as data have been collected upon the early development of reading ability, the indication is that the characteristics show themselves as early as the second grade. In fact, the writer has some data which indicate clearly that some of the foregoing characteristics of poor reading are present in the very earliest reading of certain children, and that other children have from the very first many of the characteristics of good readers. This means that some children begin with the characteristics of good readers and develop into better and better readers. On the other hand, other children begin with the characteristics of poor readers and remain poor readers. Whether children ever begin with the characteristics of poor readers and become excellent readers is not known. The solution of this problem will require that the early development of reading ability be better understood. It is an important problem which deserves the attention of the most competent investigators.

The discussion of eye-movements may be summarized as follows: (1) A detailed study of eye-movements reveals five types of data concerning reading. These are number and length of forward movements, number and length of regressive movements, and the location of pauses in the reading material. (2) Data concerning eye-movements indicate many of the changes produced in the reading process by training. (3) Eye-movement records reveal very clearly differences between good and poor readers. (4) Eye-movement records aid in determining the relation of the span of perception to reading ability.

EXTRANEOUS MOVEMENTS

The movements to be included under this head are those which have little if anything to do with the reading process. Those which may be noted in almost any school room are raising or lowering one or both shoulders, jerking the head forward or backward, and other movements which involve the greater part of the body. In most cases the children who exhibit such movements are poor readers. From this standpoint such movements probably indicate a lack of adjustment to the situation involved in reading. This means that the nervous stimuli leave the different nerve centers which are involved in reading over paths which are not in any way connected with the nervous control of the reading process. As a result of this, muscles which are not involved in reading are brought into use. To appreciate the problem with which the child is confronted in his first reading it is necessary to consider the situation in which he is placed the first time he attempts to read. In this situation the child is required to hold his book in one hand, and to hold the other hand at his side. In addition to this, he probably has to stand in a prescribed manner. In this position, which is new to him, he has new problems for his eyes, new problems of breathing, and new problems for his vocal muscles. In any other types of work where the same number of coördinations was required, the situation would be considered an exceedingly difficult one, but in reading very little thought is given to the problem. From this view of the matter it is clear that anything which would simplify the conditions under which the child does his first reading would be desirable. Extraneous movements usually accompany the reading of beginners. Certain children carry them over into their later reading, and if allowed to continue these movements, they may become fixed.

DIAGNOSIS BASED UPON THE STUDY OF MOTOR ELEMENTS

Analysis as a Basis for Diagnosis. The discussion of the last four chapters has shown two fundamental abilities involved in the reading process. These are as follows: (1) The ability to react quickly to visual symbols as required in reading, and (2) the ability to take on certain motor habits.

Reaction Time. This factor has not been studied in a very careful manner as yet, and just how large a part it plays in reading has not been determined. It seems reasonably clear, however, that oral reading may be slow and halting on account of the slow way in which the muscles respond to the stimuli. The same factor may operate in silent reading if the child reads with much vocalization. Another factor in reaction time is the rate at which interpretation takes place. This depends upon familiarity with language forms and probably upon maturity as well as native ability.

Motor Habits. The discussion has sought to show that learning to read depends upon the rapidity with which certain motor coördinations can be developed. These different coördinations involve the vocal reaction required in phonics, the breathing coördination in oral reading, and the movements of the eyes.

Tests and Observations to be Used in Diagnosis. It is clear that observation can be used for recording results upon breathing in oral reading and vocalization in silent reading. Eye-movements may be observed by means of a mirror. Such a method will indicate both the forward and regressive movements. Reaction time may be studied by means of the counting test and the pronouncing test.

INTERPRETATION

Relation of Motor Coördinations to Reading Efficiency. The studies reviewed show clearly that in many cases poor and inefficient readers are those who do not have the proper motor coördinations well established. The relation here is not always one of cause and effect; yet it seems perfectly feasible to say that, if a child is not succeeding in his reading, one method of approach to the problem would be by bringing the different types of motor coördinations to the attention of such a reader and by attempting to establish the proper motor habits. Comprehension depends upon fine motor adjustments, and if the muscular reactions involved in reading are well established, the most favorable conditions are set for comprehension. From this standpoint, it would seem that instruction in reading should take into consideration the motor coördinations in a much larger degree than has been true in the past.

Analysis. The discussion of the motor elements has thrown further light upon the relation between analysis and reading ability. Such a process is made difficult for the beginner by the fact that his oral language is highly synthesized and thus analysis becomes a tedious process. In spite of this it must be mastered, because eye-movement records show clearly that if analysis cannot be accomplished confusion may result in such a degree that the entire reading process breaks down.

Further it has been shown in detail that the motor processes involved in the analytical knowledge of words is a complicated one which involves entirely new habits. Eye-movement records have given further evidence of the importance of analytical knowledge of words. Lack of such ability results in periods of confusion, while the presence of the ability results in the pupil's being able to extricate himself from such difficulties.

Rate of Reading. The present discussion has given several factors which enter into rate of silent reading. These are as follows: reaction time; faulty eye-movements, as seen in too many pauses, or too long pauses; lack of analytical ability, as seen in periods of confusion; and too much vocalization.

Comprehension. The discussion of the motor elements has shown in detail the way in which a wide span of perception functions in rapid reading as a basis for interpretation.

Rate and Comprehension. The chapters on the motor processes have shown that a rapid reader may reduce either the number or the length of his eye-movement pauses. If the reduction should be too great comprehension would be poor. Again, slow reading is indicated by a large number of eye-movement pauses, which reduce the amount of material interpreted at each pause. These small units may also result in inaccurate interpretation.

Quality of Oral Reading. The discussion of the motor elements has treated breathing as it relates to this problem. The results obtained indicate that, for certain pupils, this organic function presents a problem which needs the careful attention of the teacher.

The Relation between Oral and Silent Reading. The question of motor coördination is also important from another standpoint. After all the motor coördinations enumerated in the chapter are fairly well established in oral reading, the child is called upon to establish a method of reading in which all the motor coördinations except eye-movements are absent. This habit is, of course, silent reading. In silent reading the vocal reactions should be entirely eliminated. The breathing coördinations are not required and the eye-movements are very different in nature. This serves to emphasize the fact that, from the standpoint of the motor processes involved, oral reading and silent reading are very different activities. The two types of reading have the same stimulus so far as the printed page is concerned, but the reactions to the stimulus are very different.

QUESTIONS AND EXERCISES

1. Notice the breathing of professional singers and speakers to see if they have a definite system of coördinations for this phase of their work.
2. Observe the eye-movement of a reader by means of a mirror to see if he uses different methods of reading when he is reading for different purposes.
3. What arguments can you see in favor of making children conscious of their motor processes while reading? What arguments can you urge against such a procedure?
4. Is it possible to simplify the complexity of the reading conditions for the beginning reader? If so, how?
5. Would it be possible to take such activities as breathing and eye-movements into consideration when grading children upon their reading?
6. If training were carried out to remedy certain defects in the motor co ordinations involved in the reading of a child, would you expect his rate and comprehension to improve? Why?

7. Make a list of the various motor activities suggested in the preceding chapters, and then rate each child in your class with respect to them. Allow the children to rate each other.

8. If you have a child who uses a large amount of vocalization in his silent reading, how can you determine whether this is a habit or a necessary phase of his reading act?

9. What dangers arise from having children in school who have speech defects?

10. If you have the opportunity, visit the oral department of a deaf and dumb school to see the methods by which the children are taught to make the different sounds.

11. What values attach to giving children exercises in pronunciation, enunciation, rapid counting, and other forms of training in which the muscles of the speech organs are made use of in ways which are somewhat unusual?

12. Does voice training have any place in oral reading work?

13. What relation exists between eye-movements and the span of perception?

14. Would you undertake to decrease extraneous movements directly or indirectly by increasing the efficiency of the reading with the idea that if the individual could read better such movements would disappear?

15. How many children are there in your class whose every motor coördination is such that they may be ranked as excellent?

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THE ANALYSIS OF READING ABILITY FROM THE STANDPOINT OF CERTAIN HIGHER MENTAL ACTIVITIES

CHAPTER XII

ASSOCIATIONS AS REQUIRED IN THE READING ACT

In addition to those mental functions already discussed,
ding may involve most, if not all, of the higher activities of
e mind. The investigation of mental performances of this
pe is more difficult than that of the processes already con-
lered. For this reason the amount of scientific data at hand
ncerning them as they relate to reading is not large, and very
tle of that which is available relates to children. It must not
inferred from this that reading can be taught without taking
se activities into consideration. The only point made is
t the treatment of these processes has not been such as to
w their place and function in the methods used by teachers.
It is the purpose of the next three chapters to consider asso-
tion, imagery, reasoning, apperception, attention, and com-
hension as they relate to reading. The first of these activities
be discussed is association. Under this topic will be con-
ered the various types of language relations which are
olved in reading. Fundamentally these relations have to
with language symbols and their meaning. The symbols
olved in reading are conventional and symbolical. There
no direct relation between them and their meaning. There
in reading, then, a system of associations which is unique and
ich is not a part of the early experiences of the child. There-
e if children are to be made familiar with these relations, they
st be subjected to some type of training. For this reason
is highly essential that the laws which underlie this rather

unusual and unique type of association should be well understood by teachers.

The relation which the child must first become aware of in his reading experiences is the one which exists between his oral vocabulary and printed or written forms. Children start to school with an oral vocabulary which consists of several hundred words. This vocabulary involves two factors, the pronunciation of words and their meaning. This oral contact with language is limited in its scope, because it is auditory in nature and does not involve visual elements. When instruction in reading begins, the child comes in contact with a written and printed vocabulary for the first time. Such training may be thought of as enriching in a large degree the child's language experiences.

The problem of early instruction in reading becomes, then, one of relating the two types of language, the spoken and the written or printed. Through such instruction the child begins to build up those associations between language forms and their meaning which are necessary in the development of reading ability. These associations will be considered further under three heads, as follows: (1) The nervous basis for association; (2) the association between letters; (3) the association between words and other large language units.

The Nervous Basis for Association. In introducing this topic it is realized that there are many conflicting theories in regard to it and that the data upon the problem are in many cases difficult to interpret. It is highly important, however, that teachers should have some contact with this phase of the reading process. In order to simplify matters very few authorities will be referred to. Those who wish to pursue the topic further will have little difficulty in finding additional references.

The nervous mechanism for reading involves the following centers of the brain: (1) The visual center, (2) the auditory center, (3) the motor centers which control the muscles required in speaking, and (4) the centers for visual, auditory, and kinaesthetic memory. Certain authors also posit a center for concepts. The relations of these various centers as portrayed by Collins (4) are shown in Figure 18. The center *V* is the seat of visual memory; *A* is the seat of auditory memory; and *K* is that of kinaesthetic memory. It seems that these different areas are specialized within themselves. The visual center has one portion which serves for verbal or word memory, while

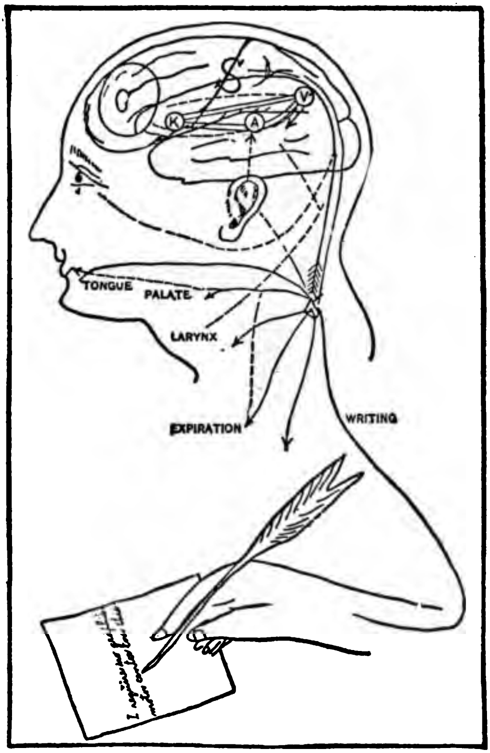

FIG. 18

Showing in a Diagrammatic Manner the Relations of the Various Centers Involved in the Nervous Control of Speech

V, Vision; *A*, Auditory; *K*, Kinaesthetic; *C*, Conception; *S*, Motor. By Collins other portions of it serve for objects. In the same way there is one part of the auditory area which has to do with the memory of words and other parts for the memory of other auditory experiences. The kinaesthetic area serves as a memory area for articulatory motor experiences. The area marked *S* is motor in its nature. It is from this area that the motor stimuli which produce the articulatory movements involved in spoken language proceed. It is generally thought that certain phases of the adjustment and coördination of these movements are accomplished in the cerebellum and other lower centers of the brain.

The centers as just enumerated are connected with each other by means of association fibers. Certain authors believe that there are also association centers. Such centers are usually said to be located in the frontal lobes. The entire nervous mechanism which has been described is spoken of as the language zone. This is represented by Collins as shown in Figure 19. The heavy shaded portion to the right is the area of visual memory; the heavy shaded area to the left of this is the area of auditory memory; while the shaded portion at the extreme left is the seat of kinaesthetic memory. In discussing this area Collins says that it is probably not strictly delimited. It is better, according to this author, to think of it as differing in individual cases, and varying at different periods of the same person's life. The final development of this area probably depends upon the experience and training of the person in the various phases and forms of language. Collins emphasizes, further, that while it is necessary for purposes of discussion to separate the center for visual memory and the centers for concepts, yet such a separation does not represent the true state of affairs. It is his opinion that a better way to think of this brain area is to consider it as made up of a series of centers. From this standpoint, the simplest sensations would be the result of a stimulus entering one end of the zone and the abstract ideas of a stimulus entering the opposite part.

A brief discussion may now be given of the various steps in the reading process considered from the standpoint of the nervous mechanism. Reference is again made to Figure 18. Reading must begin with the stimulation of the retina by the printed word. This stimulus is conducted to the primary visual center in the occipital region. The remaining part of the process can best be understood by a quotation from Collins, as follows:

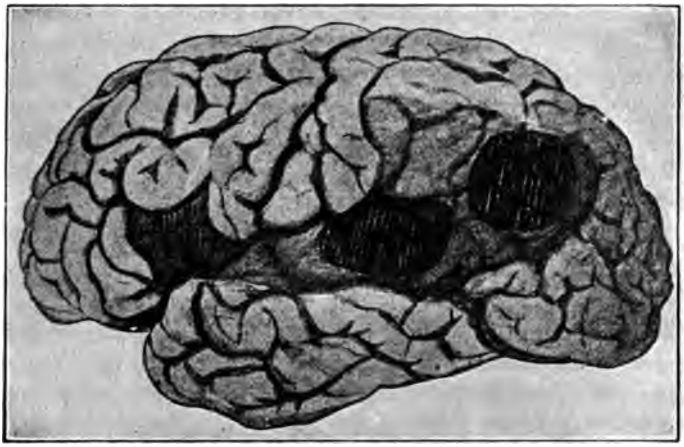

FIG. 19

Zone of Language; Position of Centers, by Collins

> To recognize and name it [a word] requires all or part of the remainder of the visual mechanism. The recognition and complete apprehension of the object requires further, that the lower visual center be in relationship with the center of visual images, so that images of the object can be contrasted with past experiences. If there have been no such past experiences, then the object is seen but not recognized or named. In order that the use, function, and wider relations of the object may be recognized, the center of visual images must be intact and in relationship with the concept center. To name the object apprehended, the concept center must either be in unbroken connection with the kinaesthetic motor center or with the auditory verbal center, which last must then *be connected* with the kinaesthetic verbal center, or

else the connection must be made through the visual center to the auditory and kinaesthetic, or to the kinaesthetic direct. It is highly probable that the first is nearest to the real condition. These connections being intact, with the connection between the visual and concept center unbroken, we shall have the perception of the object, followed by the naming of it.

The known facts indicate that the importance of these centers, as just discussed, varies from individual to individual. In certain persons the auditory experiences predominate in formulating oral language, while in other cases the visual experiences or the kinaesthetic experiences are doubtless most important. In no case, according to most authors, does one of these types of memories mentioned above produce oral language. Instead of this, it is generally thought that two or more of the different types of experiences combine in the production of such language.

The view of the reading process as presented in the preceding pages may not be absolutely true to the facts, but some such procedure must take place, and it seems probable that the foregoing makes the situation too simple rather than too complex. If this discussion gives a fair portrayal of the reading process, teachers cannot fail to be impressed with the complexity of the situation and therefore with the difficulty which attaches to it for beginners. Such a view also emphasizes the very great part which previous experience and training play in interpretation. The more times the visual, auditory, and kinaesthetic areas have been stimulated, the richer the meaning which attaches to any word or group of words.

APHASIA

Another phase of the problem at hand is the study of certain abnormal cases in which one or more factors in language ability have been lost. Some persons who have learned to deal with language in all of its aspects lose this ability through some accident which injures certain portions of the brain or through some disease which causes a breaking down of the nervous tissue. It *is from the* study of these cases that most of the evidence for the location of the various centers has been derived. Such persons are said to have aphasia. There are three general types of this abnormality. These are: Motor, sensory, and total aphasia.

Motor Aphasia. Motor aphasia is the term usually applied to those cases where the expression side of language is defective, while sensory aphasia covers those cases in which the receptive side of language is disarranged. Motor aphasia divides itself into the cortical and sub-cortical types. In cortical motor aphasia internal speech is lacking. It is the opinion of Collins that in cases of this kind the center in which there is a lesion is the kinaesthetic memory center. A subject of this sort can see perfectly so far as the eye, optic nerve, and primary visual center are concerned. Such a person sees letters and words perfectly and there is no paralysis of the tongue, lips, and other vocal parts. These organs are able to function in every way except in those coördinations which make for speech. It is often true that such subjects are able to say a few words like "yes" and "no" and other conventional phrases. These are often used as a kind of echo. Such speech may show itself when the patient begins recovery. Sometimes this type of aphasia is accompanied by a loss only of ability to use substantives, and in still fewer cases in the loss of ability to use verbs. Other cases are on record where there is total loss of speech except that the ability to count or repeat the multiplication table remains. In most instances such persons have difficulty in reading to themselves. In other cases the person is unable to read aloud. Collins gives the following stenographic report of a patient suffering from aphasia of this kind attempting to read a newspaper:

> Lead pipe his mande hen of powerful presses. This medi in operation before he invented the lead pipe places-press-the lead pipe no-they was about every s-sway-lead was cuts in pieces of the length of foot or two, which were the roller-which want, then rolled between row and rollers into lengths of to-of about ten feets.

The inability of this patient to read was probably due to the fact that he was accustomed in his normal state to use the articulatory memory center for interpreting the visual impressions, and, since the disease is of such a nature that this center is partly destroyed, he was unable to read.

In subcortical aphasia there is lack of ability to speak. In cases of this type the stimulus is received in the primary visual center and the processes of interpretation take place in the usual manner. The motor stimulus starts on its way to the various speech organs, but it is intercepted by some kind of lesion. From this description it is evident that silent reading can take place, because this type of reading does not involve the vocal apparatus in the same way as oral reading.

Sensory Aphasia. Sensory aphasia has reference to defects in that part of the language zone which is concerned with the receptive phases of language ability. Patients suffering from it have perfect sense-organs, and the centers which are stimulated by the auditory nerve or the optic nerve are intact. The difficulty seems to lie in the memory centers for auditory and visual experiences. One fundamental difference in the two types of aphasia is that the sensory form is due to a lesion in the back part of the zone. It is also true that motor aphasia develops quickly and is usually accompanied by paralysis of some portion of the body. On the other hand, sensory aphasia develops very slowly as the result of a tumor or some disease of the brain tissue. Many cases of sensory aphasia are accompanied by loquaciousness. This means that the muscles of articulation are in perfect working order, but there is nothing to govern such movements and give them meaning. In many cases this loquaciousness is gradually reduced until the person becomes mute. In other cases there is inability to use the proper words. Words of exactly opposite meaning may be interchanged. There are two forms of sensory aphasia. These are auditory and visual. The first results in word deafness, while the second takes the form of word blindness. These defects are not due to any defects in the sensory apparatus, but rather to the fact that the interpretative processes do not function properly. A person suffering from word deafness hears the voice of the other person speaking but gets no meaning from the sound. The experience must be similar to that of listening to a language with which one is not familiar and cannot understand. Sounds, other than language sounds, may be heard and properly interpreted. In cases of this type, internal reading is disarranged because much of the meaning which attaches to reading grows out of auditory memory; and when this is eliminated or disarranged, the meaning given is limited. The speaking of such persons is usually accompanied by the misplacing of words. This is due, doubtless, to the fact that the auditory center has much to do with the control of speech.

Word blindness means that there is inability to get meaning from words although they can be seen perfectly. Here, again, the sensory apparatus is perfect, but there is inability to interpret the symbols seen. The experience of the reader is similar to that of one who looks at a page of printing in a language with which he is not familiar. The technical name given to this type of defect is alexia. Some subjects may be unable to read words, and yet they may know letters even when they are unable to join them into syllables. In certain cases where the auditory centers are perfect and the reader has ability to recognize letters, he can read in a laborious manner by spelling the words aloud.

The discovery of the knowledge of letters on the part of those who were word blind had at one time a decided influence upon the teaching of reading. It was used as an argument for the alphabet method, because it seemed to indicate that the knowledge of letters was fundamental to the knowledge of words. This view has been discarded, and such facts are now considered as a result of the child's having been drilled on the alphabet before any words were taught. The effect of such a method is that the letters are more firmly fixed than are words; and as a result they are retained longer than words, when the nervous system begins to break down. It would be very interesting to know what would happen in the case of a person who has been taught to read by the word or sentence method. It is the opinion of Collins that blindness for letters and words would occur together.

Another fact concerning the abnormal defects in reading ability is seen in the recovery of such afflicted persons. They always have to relearn reading. In the methods reported by Collins the first step is to get a perspective or outline of the word. This is followed by a knowledge of the syllables which constitute the word and finally the letters which enter into the word are learned. In this process of re-education, certain persons gain the ability to read a few words at a time. After this they can proceed no further until they have a rest period. This seems to be due to a lack of excitability in the nerves concerned. Another point is that persons suffering from word blindness can sometimes read by tracing out the words with their fingers.

One particular type of word blindness is known as psychic blindness. In this case letters are interpreted as letters and words as words, but there is no memory of the recognition. This means that no trace of the interpretation is registered in the nervous system. The words may even be presented a second or third time, and the subject will not detect that he is dealing with material which he has seen immediately before.

Certain cases of word blindness have been considered by authorities as being congenital. In many instances children who are so classified come from families in which other members have the same defect. Children of this type either cannot learn to read or have very great difficulty in learning to do so. It is usually thought that they have inherited some defect of the brain which makes this type of learning either impossible or very difficult. Such children are many times perfectly normal in every other respect and are able to learn any other school subject in so far as these subjects can be learned without reading. The study of such cases has been most often made from the medical standpoint. It is highly important that defects of this type be studied from the psychological standpoint in order that various methods of training may be developed. It is possible that specialized forms of drill might serve to reduce the results of any hereditary defects which exist in the nervous system.

In conclusion, the study of the abnormal types has shown the relations which exist between the various phases of the language experiences from the nervous standpoint. These cases show clearly that every aspect of language experience is necessary in the reading activity, and that if one phase is eliminated either partially or entirely by a lesion in the nervous system the reading process either breaks down entirely or is hindered in a very large degree.

While it is true that reading is more than these physiological processes would indicate, yet the teacher of reading should realize that the intellectual phases or the emotional effects of her subject are correlated with a nervous mechanism. From this standpoint her problem is to produce changes in the nervous systems of the children whom she teaches. In so far as such changes are the results which she desires, her problem is objective and materialistic. She is confronted with a material nervous system which must be changed. But matter is inert and resists such changes. Therefore, the results of her teaching are obtained slowly and only after careful and painstaking work. If the results of teaching are thought of only in mental terms, they lack definiteness. Such a conception of the reading process makes the teacher impatient for results and gives to her work a lack of thoroughness because she does not see in objective terms the necessity for long drills. On the other hand, if she realizes that an immediate and fundamental effect of her teaching is certain changes wrought in the nervous systems of those whom she teaches, the value of patient and painstaking work is made clear, because changes in matter always require time. The foregoing is not intended to minimize the mental phases of reading, but to bring more clearly before the teacher of reading the fact that her problems have their nervous basis.

ASSOCIATION BETWEEN LETTERS

The remaining part of the chapter will concern itself with the way in which the general laws of association function in relating various language units. The relations between letters will be considered first. The various characters in the alphabet are entirely unrelated and disconnected, except as the use of them tends to fix certain combinations in the minds of those who come in contact with language forms. The methods by which such associations are built up and the effect which they have upon the reading habit are of very great importance to all teachers. Such relations have been discussed in some detail by Huey (7) as follows:

> If the visual "a" has most often had "x" appearing at its right, the sight of "a" will, other things being equal, tend to arouse the visual representation of "x," and the sound of "a" aroused by association with its optical form will tend to arouse the sound of "x" preferably. Of course, the optical form and sound "a" have been associated with many other letters, and the associative tracts representing these will also be aroused more or less. The associative tracts representing "z" and "q" letters seldom given with "a" will scarcely be aroused at all. Now if the word "ax" is suddenly exposed or appears in reading, the sounds corresponding to "a" and "x" will at once come up as the most inveterate associates with these optical forms. But the optical form "a" will call up also its preferred associate "x" with a strengthening of the optical and auditory "a" by "x" also in proportion as "a" has more or less often preceded it as compared with a probably preferred "e" (in suffixes, etc.). Perhaps the association of optical forms from right to left may be as facile as that from left to right if we accept the apparent fact that the eye receives no data during its movement forward.
>
> In longer words such as "slipper" "s" may subarouse the forms and sounds of various other letters than "l," though the association to "l" is facile as compared, for example, with that to "x"; "l" has more or less frequently been associated with "i" following, and tends somewhat of itself to call it up as compared for instance with calling up "x." But the combination "sl" has far more frequently been given with "i" than has "l" when "l" has stood alone, and thus the effect of "s" preceding "l" is much to facilitate arousal of tracts representing "l." The combination "sli" tends to arouse comparatively few letters, such as "p," "t," "c," "m," "d," etc., and the trend of association is more and more constrained as less of the word remains.

The combination "nigh" for example would almost invariably arouse "t," its almost invariable associate. In general, it only requires a direct application of fundamental principles of association to justify the statement, confirmed, however, by its agreement with the facts of observation, that letters have more or less preferred associates according to their habitual arrangements into words in a given language, and that letters presented in these preferred sequences mutually strengthen the visual and auditory perceptions of each other, and thus arouse the apperceptive complex representing the visual form of the word and its sound. When letters in nonsense arrangement are exposed, subjects often state that they have clearly seen many more than they can repeat to the experimenter. The letters as optical forms tended to call up their preferred letter-associates, but these rather hindered than helped the perception of the adjoining letters, and there could be no apperceptive knitting together into a complex which could be remembered.

The various rules of spelling along with their exceptions also develop the type of association under consideration. Again, there are many points in the teaching of phonics which result in the same kind of relations. The teacher of reading is interested in all such rules and principles, because, if these associations are formed, they will be an aid in the recognition of words. Not only are there these relations between letters, but similar connections are built up between syllables. These connections are emphasized in phonics when families of words are taught. Such associations, when well established, also aid in the recognition of words.

It is clear that the associations which have been emphasized as existing between letters result in a knowledge of words which is analytic in its character. It is detailed in nature, and makes for accuracy in recognition. This method of dealing with words is made necessary by the fact that the number of letters is small and that their combinations into words are many. As a result, many words are alike in form, and detailed knowledge of them is necessary for rapid and accurate recognition. These associations also place the work of the child upon a different plane from that upon which it exists when training in analysis first begins. The first analysis is usually carried on letter by letter. This is a tedious and slow process and can have but few principles of laws underlying it. However, after the child has become accustomed to language forms and understands syllabication, his analysis of words is upon a much higher plane. Such work is relatively rapid, and can be based upon those laws and principles which are to be found in phonics or spelling. The type of association under consideration may also be of aid in the recognition of words which are unfamiliar. Certain units of letters can be recognized and the word built up from these units rather than from the individual letters. A person who can deal with words by means of units composed of two or more letters instead of individual letters may also be able to anticipate in a measure a word with which he is dealing. Such anticipations may at first lead to wrong interpretations, but as experience is gained the result will be more rapid work.

ASSOCIATION BETWEEN THE LARGER UNITS OF LANGUAGE

Another form of association to be considered is that which exists between words and other larger units of language. This may be spoken of as the "feel" for language. It represents a definite stage in the learning of a new language. At first a strange language is used by an adult either in a purely logical manner, or as a matter of imitation. However, if the person persists in the use of such a language, there comes finally a freedom in its use which is usually explained by saying that a feeling for the language has been developed.

In his chapter on the *Stream of Thought*, James (9) emphasizes the fact that in all thought there are certain resting places and other places of movement or flight. The first he speaks of as "substantive parts," and the second as "transitive parts." The object of all thought, then, is to get from one substantive part to another, and this movement is accomplished by means of the transitive parts. To James those transitive parts exist as feelings of relation. In this connection, he says:

> There is not a conjunction or a preposition, and hardly an adverbial phrase, syntactic forms or inflection of voice, in human speech, that does not

> express some shading or other of relation which we at some moment vitally feel to exist between the larger objects of our thought. . . . We ought to say a feeling of *and*, a feeling of *if*, a feeling of *but*, and a feeling of *by*, quite as readily as to say a feeling of *blue* or a feeling of *cold*.

Another important point brought out by James is concerned with "feelings of tendency." The idea here is that many portions of speech are *signs of direction* in thought. To illustrate, suppose the expression "naught but" or "nevertheless," or "however" occurs in a passage being read. In such cases there comes immediately a sense of the direction in which the thought is to proceed.

The same idea is expressed by James when he discusses the intention of saying a thing before it is said. A good illustration of this view of the problem is seen in one's ability to read aloud a selection for the first time and yet be able to emphasize the words correctly. Such a fact must be accounted for largely in terms of intention, as whenever "no more" is used "than" is expected to follow.

If one attempts an extemporaneous speech, it exists at first only as an intention to say so and so; but as the speech proceeds, one part of the speech calls for another, and one sentence calls for another until the speech is complete. In delivering such a speech it often happens that a word gets in too soon. This can only mean that the word existed in a nascent form and that for some reason it got into the train of thought ahead of its regular place. Another illustration of the same point is the fact that words seem to cling together in groups or vocabularies. If a sentence is started in French, the French words continue to come; or if the sentence is started in Spanish, it is finished in Spanish. There is but slight tendency to mix up vocabularies.

In this connection Huey (8) speaks in one of his experiments of "feelings of expectancy, curiosity, strain and forward push" which were reported by his subjects.

Wundt (14) has emphasized the fact that any sentence begins with a total meaning or a total idea. In the case of the child or aboriginal man, this total idea takes the language form of a single word, but later development either in the individual or in the race breaks this total idea up into various parts of speech.

The value of the ability to anticipate with some degree of accuracy the meaning which is to come in a passage as a phase of reading cannot be overemphasized. It is analytical in its nature and involves the details of language. It probably aids very materially in increasing the span of perception, and as a result the rate of reading is augmented. If a person reads a part of a sentence and is able to anticipate the remaining portions of the thought in an accurate way, interpretation must be on a higher plane than if the same person found it necessary to examine each of the remaining words in the sentence being read. This makes out of reading a kind of scientific guessing and allows the reader to move forward with fewer cues than would otherwise be necessary. In the early experiences of children such procedure seems impossible, and the first attempts at such are doubtless only partially successful; but as experience is gained, these unsuccessful attempts decrease.

It is unfortunate that there are no studies based upon children's reading which emphasize the development of ability to anticipate meaning. The early reading of the child is reading word by word. The efficient teacher begins, almost immediately, training which is intended to give the pupil the ability to deal with larger units. As soon as the child can successfully interpret the larger units of language, he is ready to enter upon a new phase of his reading. The changes in the reading ability of children which result from this reaching forward for meaning should be better understood. If the beginnings of this reaching forward for meaning are shown in the third or fourth grade, as they probably are, it may explain many of the erratic results which are obtained from the reading of these grades. During this transition period it seems that the child is able to use the anticipatory method of interpretation in dealing with certain *selections*, while other passages are of such a nature that the new method cannot be employed and as a result he must revert to interpretation based upon small units.

It is this ability to anticipate meaning which allows certain children to read very rapidly or to use the process of skimming to advantage. Such readers get the topic sentence of a paragraph and their knowledge of the author's views and of the topic at hand allows them to anticipate the remaining portions of the paragraph.

Instruction which has to do with the anticipation of meaning has received very little attention from the standpoint of reading. It is true that some work which bears upon this problem has been done in grammar and other language studies, but it is very doubtful whether the child ever transfers this training to his reading. Instruction of this type should have a definite place in the teaching of reading. Most persons who develop this method of dealing with language have acquired it in a random and unorganized manner. Its importance is sufficiently great to give it a very definite place in the reading curriculum. Turner (13) has emphasized certain phases of instruction in reading which may be mentioned in this connection. Her work includes, among other topics, studies in the relative value of words, groups of words, connectives, etc. In all cases the emphasis is upon the finer and more detailed shades of meaning, which is essential if the ability to anticipate meaning is to be developed. Such work cannot fail to give the pupil a better appreciation of meaning, and will probably do as much towards increasing efficiency in reading in the upper grades as any other type of work.

Two tests which have for their purpose the measurement of language ability will be discussed. The first of these is by Trabue (12). This test is known as a completion test. It presents to the subject a story with words omitted. The problem is to supply the correct words in the blank spaces. The author of this test does not state definitely what type or types of ability it measures, but evidently it involves language relations and vocabulary. Results have shown that there is a high correlation between the results of this test and certain reading tests. The second test to be mentioned has been devised by Green (6). This test has in it a number of disarranged sentences. The problem is to rearrange the words so that they form sentences with meaning. The author is of the opinion that the test is useful in detecting the ability fundamental to composition work.

To summarize, association in reading involves four different problems, as follows: (1) The relation which exists between oral and printed language forms and their meaning; (2) the nervous basis for association; (3) the association between letters as they are found in words, and (4) associations between larger units of language. All of these have a part in reading ability, and will be spoken of in terms of language ability from this time forward rather than in terms of association.

CHAPTER XIII

IMAGERY AND APPERCEPTION AS INVOLVED IN THE READING PROCESS

The next type of mental activity to be treated is imagery. There are two phases of this process as it relates to reading which should be kept in mind. First, it may refer to results obtained by means of reading. To illustrate, a teacher may be interested in having children form a correct and definite image of the setting for the poem *Snow Bound.* Again, the history teacher is often concerned with getting children to visualize historic events, or the geography teacher may find it desirable to strive for a clear mental picture of certain geographical details. This phase of imagery is highly important, but it is a result of reading, rather than a part of the reading act. Therefore it will not be considered further. Second, imagery refers to a type of mental stuff which accompanies or forms part of the reading activity. From this standpoint imagery represents an intermediate step between sensation and final interpretation. This means that often there is no immediate and direct route from sensation to meaning. When interpretation takes place in this indirect way, the image plays a prominent part. The problem at hand is to give briefly something of the nature of imagery and the place which it occupies in the reading process.

The Nature of Imagery. The imagery which is involved in the reading process may be of many different varieties. In fact, there may be as many classes as there are different senses. The types most often considered are the visual, auditory, motor, and kinaesthetic. Without doubt many persons use all of these types and change from one to the other very rapidly. This means that if visual imagery accompanies the reading process, there is a series of mental pictures either of the objects referred to by the words or of the words themselves. Again, if auditory imagery accompanies the reading, the words are heard or certain other sounds come into the mental activity. The same general law holds for each type of imagery. Huey (7) brings out the relation of imagery to other phases of reading in the following words:

> Provisionally and roughly, I should say that in reading there were two sets of processes, somewhat independent and paralleling each other: (1) A reading in terms of interassociated word and phrase units (themselves composed of interassociated sub-units), thought in a variously proportioned combination of visual, auditory, and motor elements; (2) a reading (or interpretation) in terms of direct representations of the realities with which the subject matter deals; a picturing in sense terms of what the words symbolize.
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> The relative prominence of the two processes varies greatly with the individual, and, of course, with the subject matter as well. The first is the constant process, is the major part of the performance for most readers; is the part which makes the heavy draft on the psychological machinery in the fatiguing and delaying process. It is the *ding an sich* for the average reader.
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> The second process is a sort of dramatization in which the reader sees and hears and smells and tastes, and takes a part. Consciousness may almost desert the first process in its interest in the scenery of the second; yet this scenery is constantly being changed by the word-workers behind; and it may be jarred to confusion by a wrong arrangement of word or phrase.

Another important phase of this question is the part which verbal imagery plays in mental life. It is well known that many persons make use of this type of imagery. It is a method which deals with language without careful and accurate evaluation. Such methods may be illustrated by the mathematician who is continually dealing with symbols. He performs many different operations with these symbols without thinking of their usual meaning, and in many cases it might even be difficult for him to give an accurate evaluation of them. He may develop an entire system of symbols covering many pages, and then represent this system by some new symbol, say X. This X may now be introduced into other systems without the mathematician's having to think of its usual meaning. Most of the work done in mathematics is on this plane. So it is with language; the reader is able to use a large number of words without thinking, in each particular case, of their exact meaning. It is clear that only trained and experienced mathematicians can use the plan outlined above in a satisfactory way. A first-year algebra student could not employ such procedure without disastrous results. By the same token, only the experienced reader can use the verbal method of dealing with words. Language is exacting in its demands, and anyone who attempts abbreviated methods of dealing with it must have broad experiences or else pay the penalty.

The Value of Imagery. With respect to the general problem involved here, there are two rather distinct theories. Some authorities hold that imagery is not necessary and that the reading activity can proceed without it. Again, there are those who hold that some form of imagery is necessary. Huey's (8) results show a dearth of imagery for prepositions, conjunctions, and other relational words. Such results indicate that, in certain phases of the interpretative processes of reading, imagery plays only a small part. Goldscheider and Müller (5) in their work upon perception emphasize the value of auditory imagery, and Zeitler (15) in his work upon the same general problem places much value upon visual imagery. If space permitted, many other authorities might be cited upon this problem. The net result of such a survey would be, on the one hand, a series of arguments based largely upon introspection setting forth very strongly the theory that some form of imagery is necessary in all mental activity and therefore in reading, and on the other hand, another series of arguments which set forth just as strongly that imagery is not a necessary factor in mental activity. In view of this fact, the value of imagery is in doubt. It may be possible that the two opposite opinions as just set forth represent individual differences and that for certain persons imagery is necessary and for others it is not. It seems safe, however, to say that the part which imagery plays in mental life has been overestimated. It is probably true that most persons use some imagery, but it is exceedingly doubtful, except in rare cases, that a complex and highly organized system of imagery is required. In addition to this, many authorities are of the opinion that imagery does not play a fundamental part in mental activity, but rather a secondary part. In other words the image serves only to center or focus attention, whereas the meaning is much more fundamental.

Just how large a part it plays in the reading activity of children is not well known. Huey is of the opinion that it plays a much larger part with children than with adults. If Huey is correct in this statement, it is interesting to speculate as to its probable effect. If he means that the imagery of the child is complete and full, then it is easy to see how there might be a retarding influence upon the rate of reading. This would mean that if the child came to the word "house," the image produced must be complete and accurate in details in every respect. If such imagery should accompany most of the words read, it would doubtless render the process of reading so cumbersome as to hinder both rate and interpretation. On the other hand, if Huey meant to convey the idea that the child's imagery is concrete rather than verbal, then there need be no hindrance of the reading process, for it is well known that concrete imagery may be so much abbreviated that it would not stand in the way of a very rapid rate. If adequate means were at hand for studying the problem, both types of children would doubtless be found. It is an important problem which needs further study.

Imagery has had little or no attention paid to it in its connection with reading. The child is allowed to develop and employ imagery in his own way. This is due to the fact that it is very subtle in its nature and therefore exceedingly hard to deal with in the case of children. It may be that certain pupils develop a system of imagery which is complex and which retards and holds back their reading process. A teacher of deaf and dumb children recently made the statement to the writer that many children of this type who learned the sign language first were always slow readers. It was his opinion that this was true because the sign language carried with it a cumbersome and complex type of imagery. If this statement be true in regard to deaf and dumb children, it is not impossible that the reading of some pupils who use oral speech is accompanied by imagery which is too clumsy and cumbersome to allow efficient interpretation. It may also be true that certain other children develop an abbreviated system of imagery too rapidly, and as a result fail to get meaning from what they read. This might be true of children who are required to eliminate lip movements too rapidly.

Another difficulty which attaches to this problem as it relates to children is the absence of standardized tests for this type of mental activity. This fact, along with other points previously mentioned, makes the control of imagery as it relates to reading seem a hopeless task at the present time.

The discussion may be concluded as follows: (1) Imagery is present in the reading of most persons. (2) A few persons are probably able to arrive at meaning without imagery. (3) Many different views as to its value are held. (4) No means for the control of it in the reading process has been developed.

APPERCEPTIVE FACTORS IN READING

Under this heading are to be discussed briefly certain subjective factors which determine or help to determine interpretation. It is usually conceded that new ideas entering the mind come in contact with a certain mental set or mental system which determines in a large degree the interpretation to be given.

In his work with mutilated words, Pillsbury (9) gives a list of eight factors which seemed to determine the meaning attached to the various words exposed. These are as follows:

1. An associated word called just before the word to be read was shown.
2. The preceding word in the series.

3. An earlier suggestion (this is valid only when several exposures are made).

4. A word the subject had spoken or intended to speak immediately before the exposure.

5. Interesting events of the preceding day.

6. The word of the preceding hour.

7. The general disposition of the subject, which determined the way in which a called word of ambiguous meaning was understood and so its effect upon the reading of the word shown.

8. The subject's knowledge that the words contained misprints.

In Bagley's (1) work with mutilated spoken sentences, the following points are emphasized:

1. That distraction of attention militates against the complete apperception of the meaning of the sentence.

2. That familiarity with a sentence sometimes militates against a clear and definite reference on the part of the observer.

3. That the apperceptive consciousness is constantly changing to meet the changes in the context.

4. That a doubt or conflict as to meaning gives rise to a feeling of unpleasantness.

These studies list a number of factors which determine, in a measure, the meaning which attaches to material as it is read. That the teacher should understand the influence of such factors and that she should be able to see their influence in the reading of children go without saying.

The same general problem as it relates to errors in oral reading has been studied by Bawden (2). A partial list of such errors, along with their classification, follows immediately:

1. Errors showing tendency to form familiar words or word-parts.

Incorrect form	*Correct Form*
Ware-fell	Well-fare
Com, ing up	Come, ring up

2. Errors due to similarity in sound of adjacent letters, word-parts or words.

Incorrect form	*Correct form*
It will give father a Charles	It will give father a chance to pitch into Charles

3. Errors due at once to persistence and to anticipation.

Incorrect form	*Correct form*
Fraternal rations	Fraternal relations
It is at least too early to afform	It is at least too early to affirm that gold monometalism has won

4. Ellipsis due to previous pronunciation of the same letter, word-part, or words.

Incorrect form	*Correct form*
In raising bead	In raising bread
Truly normons	Truly enormous

5. Oral ellipsis due to anticipation of letters, word-parts, or words.

Incorrect form	*Correct form*
Chronic	Chronicle political
The chairman rose in his pace	The chairman rose in place, pale, and agitated

6. Oral persistent transposition.

Incorrect form	*Correct form*
Mile distants	Miles distant
Cheek looks	Cheeks look

7. Oral anticipatory transposition.

Incorrect form	*Correct form*
Fetch the box at once	Fetch the box at once as she promised
I say the sfear	I say the fear should fall

8. Oral persistent substitutions.

Incorrect form	*Correct form*
I have kept the faith; I have fought the good fith	I have kept the faith; I have fought the good fight

9. Oral anticipatory substitutions of words.

Incorrect form	*Correct form*
Jael took her into her private apartments	Jael took him into her private apartments

10. Oral examples of coalescence which involve the modifications of vowels or consonants.

Incorrect form	*Correct form*
Our corkey (The "o" in "corkey" was pronounced as in "cork")	Our turkey was cooking

11. Examples of oral exchange.

Incorrect form	*Correct form*
A jog-lammed creek	A log-jammed creek
Reats are rool	Roots are real

These points have a very large place in the interpretation of certain errors which children make in their reading. Many mistakes made by them are due to the mental set or the background of meaning with which they approach a selection. If two words have occurred together a number of times in the experience of the child, the tendency is for the first word of a series to call up the remaining words of the series. This may result in gross mispronunciations and substitutions. It is also true that the experience of the previous day or the preceding recitation period may be carried over into the reading lesson. In this way it might be shown that each element in the list just given plays a part in the errors made in reading. There seem to be those children who are much more susceptible to these apperceptive influences than others. Whether this is due to a fluctuation of attention or to other factors in mental activity is not well understood. It is a factor, however, which every teacher of reading should keep in mind as a means of interpreting errors. Mistakes of the type listed by Bawden are often more or less accidental in nature and need have but little attention given to them. A child who makes an error like those just enumerated does not necessarily lack familiarity with the words miscalled.

Such errors have been spoken of by Bawden as lapses. From this standpoint it is clear that such mistakes will happen only occasionally, and time spent in drilling on the word miscalled or in censuring the child is time wasted.

The discussion has also suggested one danger which may come from the apperceptive influences. This is inaccuracy. This means that the reader may place his own interpretation upon many passages and so become inaccurate in comprehension. Careful and detailed reading will, in most cases, serve as a sufficient check upon this.

Reading Material. The preceding pages have indicated the influences of certain phases of the early experiences of the child with respect to his reading. More generally considered, the term "experience" may include all the learning of the child. This view of the matter gets its importance from the fact that if an extensive background of experience is acquired by the child, it enlarges and enriches the meaning which attaches to any material read. It enables interpretation to take place more rapidly, and hence increases the rate of reading. It makes for understanding and stimulates an interest in reading. This means that a certain part of the material read by children should be within their mental grasp, and should have a meaning which fits easily into their experiences. Probably the greatest single change that has been made in the text-books of reading is in this respect. The early text-book was filled with religious and moral passages, which had but little interest for children because of the absence of experiences which serve as a basis for the interpretation of such material. Modern readers attempt to bring together selections which are adapted to the child mind.

The selection of material for the reading of children is not an easy task. Most teachers have given this problem little thought, and have had little training in evaluating and in finding proper material. A discussion of some phases of this problem has been given by Bobbitt (3). He emphasizes the fact that the child lives in a complicated world and should therefore come in contact with various types of reading. The forms enumerated by him are as follows: (1) Material which introduces the pupil to occupational activities, (2) material which presents a wide and full revelation of human nature, (3) scientific material, (4) material concerned with health, physical development, sanitation, etc., (5) folk-stories, fairy stories, etc., (6) historical material.

It should be pointed out that each of these types of material may exist on various levels. This means that if science is to be understood by a fourth grade boy, it must be in a different form from material of this type which would be of interest to a high school boy.

In conclusion, the law of apperception seems to apply to the reading process in at least three ways: (1) It gives certain facts as to the mental set, which determines in a measure the interpretation to be made; (2) it determines certain types of errors which occur in reading; (3) it determines the amount and degree of interest in various types of reading material.

CHAPTER XIV

ATTENTION, REASONING, AND COMPREHENSION IN THEIR RELATION TO READING ABILITY; DIAGNOSIS FROM THE STANDPOINT OF THE HIGHER MENTAL ACTIVITIES

This chapter will concern itself first with attention. General psychology has stressed two laws of attention which are applicable in this connection. One of these states that most, if not all, mental activity involves effort. Reading is an activity, a process which goes on. The continuation of this process for any period of time means that energy has been consumed and that effort has been put forth. It is well known that there are many conditions under which reading is done where the conscious effort required is very small, and that there are other circumstances where the conscious effort must be very great if it is to accomplish its purpose. For most pupils the type of reading material and the purpose of the reading will determine the amount of effort which is required. There are, on the other hand, certain pupils all of whose reading is done with a degree of effort which is not requisite for the purpose to be accomplished. It is highly probable that many children, as well as adults, might place their reading on a higher level by a slight increase in the amount of effort which they exert.

It would be exceedingly interesting to know the factors which determine the level of effort upon which the reading of a pupil proceeds. A few readers have been found who expressed great surprise at being able to increase the efficiency of their reading by means of a little extra effort.

One value of speed tests in reading lies in the fact that they give the "feel" of different levels of the reading activity. In this way children learn what reading means in terms of energy put forth. It is highly probable that such exercises do much in helping to pitch the reading of a pupil upon the proper level of effort. It is not argued that all the reading of a child should be done under great stress and strain, but rather that there is a certain economical level upon which the reading of every pupil should be placed. This, of course, is an individual matter and it is the business of the teacher to help each pupil find his most economical level.

The second law of attention has reference to the focus and margin of mental activity. According to some psychologists, this gives rise to a state of clearness with respect to certain parts of the mental field, while other parts are much less clear.

An extreme form to which this mental state may lead is shown in the reading of a page after which not a single word is remembered. In such cases the focus of the mental activity of the reader is not concerned with the material read. This type of attention may occur in the reading of most persons at certain times and under certain conditions, but it does not represent a fixed habit of reading for a normal person.

A second type of attention is to be seen in reading where there are many fluctuations. The matter to be read remains in the focus for only a short time. There is then a shifting to some unrelated topic or event, and the reading lapses into the form described above This may continue for only a few words or for a few lines. There is then a shifting back to the reading material. Such a procedure means that connections are lost and little or no meaning obtained. If anything is accomplished, the reader must go back and reread what he has gone over. Such seems to be the habitual type of reading for many children. It is usually described as careless and indifferent. It probably grows out of a general mental lassitude or indifference toward the material read. It is certainly a wasteful method, and every means should be used to eliminate it before it becomes firmly fixed as a habit of work.

A third type of attention may be described as one in which *there are* few fluctuations and in which the amount of effort is small. The reader gets the meaning, but there is no great expenditure of mental energy. This type is well illustrated by reading for pleasure. In reading of this kind the context is often such that comprehension can proceed readily and easily. The interest involved is immediate, and the reader is conscious of little effort.

A fourth type is represented in that reading in which there are few fluctuations, or if there are fluctuations they are so short in duration that little if anything in the way of meaning is lost. This level is carried on under considerable mental strain and effort, and is well illustrated by the reading which we designate as study.

A fifth level is to be seen in the reader who is so thoroughly concentrated upon the material which he is reading that he may not hear anything which goes on around him. The fluctuations of attention are reduced to a minimum, and the large effort which is exerted is shown by the general contraction of the body, and the changes which take place in breathing and circulation after the passage or selection is finished.

The problems of attention represent another phase of the reading process for which methods of control have not been developed. Skillful teachers may be able to deal with it in particular cases.

REASONING AS A PHASE OF READING ABILITY

The only study upon this mental process which is of interest at this time is that by Thorndike (11). This author emphasizes the fact that correct reading requires (1) that each word produce a correct meaning, (2) that each such element of meaning be given a correct weight in comparison with the others, and (3) that the resulting ideas be examined and validated to make sure that they satisfy the mental set or adjustment or purpose for whose sake the reading was done.

From a consideration of the above mentioned requisites it is seen that *reading has three* elements which relate it very closely to reason. First, it is reasoning in the sense that there is always a problem to be solved. Second, there is meaning which comes from single words or groups of words. Such a step is largely on the level of perception and provides the ideas which serve as a basis for the reasoning. Third, there must be an evaluation of these meanings. This means that they must first be accepted in a provisional way, and then weighed and balanced in the light of the purpose. If a word is given too little weight or too great weight, the meaning which is given to the passage will be wrong.

The reading which Thorndike is discussing is not reading in the high school or college, but reading wherever it may be found. The child who is just beginning to read is confronted by this reasoning element. It is this fact which lends much to the difficulty of reading and is evidently one reason why certain children master it very slowly. From this standpoint, reading becomes one of the highest forms of mental activity, and the successful teacher must keep this fact in mind in all her work.

COMPREHENSION AS INVOLVED IN READING

The term " comprehension," along with its synonym *interpretation*, has been used thus far in the discussions with little or no attempt to give definite meaning to it. It is now the purpose to give a brief discussion of these processes. This will be included under three general heads, as follows: (1) the conditions which make for a rapid and efficient interpretation, (2) types of comprehension, and (3) the nature of meaning.

Conditions Which Determine Interpretation. The discussion in preceding chapters has already suggested the solution of the problem involved in this topic. Comprehension, if it is to be efficient, requires a wide span of perception and the ability to observe. It also requires that many different motor coördinations be well established, and that there be familiarity with language relations. Again, there must be a rich background of experience, an abbreviated system of imagery, as well as the ability to attend to and to evaluate ideas properly. The foregoing represents the conditions which are required if the process of interpretation is to take place. Such an enumeration of factors represents the situation after the process of reading is well established, not the conditions which exist the first time the child undertakes to read.

Not a few authors have recently placed emphasis upon training in comprehension, yet few, if any, directions are given for conducting such training. It is probable that these writers have in mind certain of the conditions already mentioned, especially those which have to do with language forms and language relations. This may be thought of as an indirect attack upon the problem and is probably the only feasible one.

Types of Comprehension. This topic is meant to call attention to the fact that comprehension is not all of the same kind. The type of comprehension which is involved in the interpretation of a passage depends, to a certain extent, upon the aim of the reading. If the aim is pleasure, the comprehension is different from that in which the aim is one of reproduction or answering questions. From this standpoint, it is doubtless true that there are as many different kinds and levels of comprehension as there are purposes and aims in reading. A very general classification gives three types of comprehension. The first of these may be thought of as intellectual in nature, the second as involving action, and the third as appreciation.

The comprehension referred to thus far has been for the most part intellectual in nature. In reading of this type it is facts and their relations which are desired. Comprehension of this type is of such a nature that it can be conveyed to others with considerable success. Our language is composed largely of words which allow the communication of experiences of this kind. There is some evidence that this type of comprehension divides itself into various specialized forms. Comprehension from the standpoint of answering questions is different from comprehension based upon reproduction or outlining or other types of reactions required by the school. The practical problem in this connection is concerned with the training which should be involved in these different types of comprehension. At present the school gives a general type of training in reading and expects this to suffice in all kinds of reading. It seems that the later training in reading should become more specialized, and that different types of reading should be taught.

A good example of comprehension which is on the plane of action is the direction test. Here the comprehension is shown by certain simple acts. In school work, assignments are of the same general type. The comprehension of the pupil is shown by what he does. This is an important type of comprehension which is probably used too little in school work.

Comprehension as appreciation may be divided into two general classes. First, there is appreciation which is attached to the reading of a poem or other form of literature; and second, there is appreciation which comes from the understanding of a general situation. An example of the second type is the appreciation which may be aroused in the child's mind from a correct understanding of the hardships of our forefathers. Both types are highly important and should be emphasized in school work.

Comprehension as appreciation has in it an emotional element. It is an individual experience. The very fact that it is individual in character means that it cannot be conveyed to others with great success. This fact makes the appreciation lesson difficult to teach, because there are no adequate checks for the results. Sometimes oral reading is taken as a check, but it is often true that the child may read well orally, while in reality he has not appreciated the selection read. This makes it very difficult for the teacher to know whether she has succeeded in teaching a selection where the comprehension is of the appreciation type.

It seems clear that the laws of rate of reading do not apply here. Appreciation can hardly be thought of as proceeding at a definite rate. Appreciation cannot be hurried. If this is attempted, appreciation as such ceases. Comprehension of this type has in it certain elements of leisure. It must be allowed to follow the pupil's own whims and fancies. It does not follow general laws as they have been emphasized in other connections. This type of comprehension is difficult to measure. The points cited above give rise to this difficulty. The fact that no methods for measuring this type of reading have been developed has resulted in its not being emphasized in current literature. Some teachers seem to be neglecting both the material upon which this kind of comprehension is based and the methods by which it is taught. There is need for a great deal of emphasis upon reading of this type. The methods of instruction present problems to the most skillful teacher and it is evident that a more perfect technique needs to be developed.

Nature of Meaning. The difficulty in determining the nature of meaning lies in the fact that, like all other phases of mental activity, meaning processes seldom if ever occur alone. They are always associated with other forms of mental activity and to separate them from their accompaniments is not easy. There are, however, certain experiences in mental activity which allow an analysis of the various factors which enter into them to be made in a way which shows the nature of meaning in a satisfactory way. For example, imagery is a form of mental activity in which such a separation may be made by those trained in introspection. Certain processes which often accompany imagery and which are usually considered as imagery are evidently meaning. This is especially true of certain phases of imagery which have to do with the inner speaking of words. In many instances some of the processes in inner speech take the form of feelings and motor tendencies. Such feelings and motor tendencies are probably highly individualistic and unanalyzable and evidently approach pure meaning.

Certain phases of perception also give some data as to the nature of meaning. A long span of perception allows a prevision or a partial interpretation, which is followed by other activities of a sensory or motor nature that result in full meaning. These partial interpretations can probably be best described as general forms of mental activity which must have the nature of pure meaning; but since most meaning is attached to sensory experience, such as sounds of words or to motor experiences such as speaking, these pure meaning activities do not suffice. They must be supplemented by other experiences.

The same kind of results is to be found in the short-exposure experiment. In that part of the interpretation which has been spoken of as the third level, there often occurs the feeling of what the words are like, but they can neither be imaged or vocalized and as a result they cannot be dealt with in any definite way. This feeling of what words are like is probably very similar to meaning in its final form. Still another similar experience is found in the anticipatory feelings for the thought which is to come in a passage. These are indefinite and intangible in their nature; but as the reading of the passage proceeds and as more sensory experiences are added, they become clear cut and definite ideas.

It seems that pure meaning is approached most closely in those experiences in which there is in the mind every phase of a word except the pronunciation. In such instances the meaning as feeling or as motor tendencies is present, but this does not suffice. Pronunciation must be accomplished before full satisfaction with respect to the word is gained. These examples are sufficient to show most of the characteristics of meaning. It apparently has in it large feeling elements. These feelings indicate what the word is *like*, how it feels to say it, and how it feels to sound it. Meaning also has in it large motor tendencies. These motor tendencies give a sense of *direction*, as is experienced when attempts at recalling a word lead to the pronunciation of the wrong word.

DIAGNOSIS FROM THE STANDPOINT OF THE HIGHER MENTAL ACTIVITIES

The different types of the higher mental activities as discussed include some of the most important phases of reading. Unfortunately there are few tests at hand for evaluating these types of ability as they relate to reading. Certain tests have been devised for dealing with language ability, but these are general in nature and do not attempt to analyze and evaluate different phases of language ability as it is involved in reading. Tests which give data as to the pupil's ability to deal with larger language units and with language relations are very much needed.

In the same way there should be tests to measure reasoning ability in reading. Such a test would involve a careful evaluation of different words and phrases in a selection. Such an evaluation would need to be given in numerical units so that the pupils' overevaluation or underevaluation could be definitely estimated. The difficulties which attach to any type of test for imagery are well understood, and the different methods for evaluating comprehension have already been discussed. It will be seen from the foregoing that the contribution of the various points in the chapter toward diagnosis will be of a very general nature.

QUESTIONS AND EXERCISES

1. Have you had children in your classes who seemed to have very concrete and elaborate systems of imagery? If so, how did it manifest itself?

2. Is there danger of the child developing verbal imagery too early? How could you avoid such?

3. Have you had children who may have been word blind? What special types of training did you use in their cases?

4. Pick out five of the selections in the reader used by your class which the children like best, and any five which they like less. Estimate the extent to which previous experiences of the children determine their likes and dislikes.

5. Make a list of one hundred errors in oral reading. How many of these are due to apperceptive influences such as the work of the previous lesson, material read at home, etc.?

6. Give some standardized test in silent reading to your class and study the mistakes made in the results with a view of determining the influence of apperceptive factors. Study the same results from the standpoint of overevaluation or underevaluation of particular words or phrases.

7. Rank your children with respect to the effort which they put into their work. In how many cases can you assign definite reasons for lack of effort? In those cases where no definite reasons can be assigned is it possible to increase the effort by speed drills or other types of training?

8. Is there any difference between the mental activities involved in the interpretation of the symbols (words) in reading, and the symbols which are used in algebra and other forms of mathematics?

9. In what sense is reading a science of symbols?

10. Do you have children who seem to be able to reach forward and anticipate meaning? If so how does this ability manifest itself?

11. Are there those children whose chief difficulty in reading seems to be a lack of ability to attend to the meaning of the material read? What means do you use to remedy this defect?

12. Is it necessary to take precautions in order that children may not get wrong meanings for words through wrong associations? Can you cite examples in which this has been true?

13. When are associations sufficiently strong so that a word may be said to be learned?

14. In what sense is meaning an individual matter? In what respect is it general?

15. Is the meaning which a first-grade child attaches to a word necessarily the same as the same child will give the same word later? What will determine the difference?

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E. GENERAL SUMMARY

CHAPTER XV

RELATIONS EXISTING AMONG THE VARIOUS FACTORS WHICH ENTER INTO THE READING PROCESS

It has been the purpose of the preceding chapters to give in some detail a systematic analysis of the reading activity as it has been revealed by scientific studies. It remains to show more clearly the relations which exist among the various factors or elements as they have been set forth. This will be done from six different standpoints, as follows: (1) By contrasting reading as a school product and reading as a process; (2) by discussing types of readers; (3) by pointing out certain factors the underdevelopment or overdevelopment of which make for defects in reading ability; (4) by a discussion of analysis and synthesis; (5) by pointing out differences between oral and silent reading; and (6) by contrasting the reading of adults and of children.

Reading as a School Product

It has been reiterated constantly in the preceding pages that reading is a process. In another sense reading is a result of the instruction of the school and as such it is very truly a product or an attainment. The teacher is often more interested in her subject from this standpoint than from any other. In silent reading, among other aims, she is concerned with developing in her pupils the ability to comprehend rapidly and accurately, while in oral reading it is a part of her problem to produce readers who proceed at a rate which is adapted to this kind of reading, who are accurate in their pronunciation of words, and who are able to use with a greater or less degree of effectiveness certain elements of technique, such as inflection, pitch of voice, etc. These are the results or products for which she is being more and more held responsible, and it is here that her interest is very intense. If reading were a simple activity which could be accomplished in the case of all pupils with equal ease in a short period of time, no further knowledge of this subject would be necessary on the part of the teacher. As a matter of fact, reading is highly complex. Its accomplishment in any efficient manner requires a considerable period of time, and the ease with which it is accomplished varies much from pupil to pupil. This condition requires that if the teacher is to be intelligent about her work, she must have a detailed knowledge of the factors which enter into rate, comprehension, etc. Such a body of knowledge is to be found in the psychology of the various mental activities which are involved in the reading process. This knowledge gives her fundamental principles as a basis for her methods and enables her to vary them to meet the needs of individual pupils.

The scientific facts concerning reading as a school product have been contributed almost entirely by standard tests. One of the fundamental reasons for the widespread interest in this type of work is that it has dealt with school products in a manner that was of immediate and direct value to the teacher. One of the greatest contributions which this movement has made is the very great interest that it has created in scientific material on the part of teachers in service.

The knowledge at hand concerning the mental processes that underlie reading as a product was acquired, in a large measure, by means of laboratory methods before teachers had arrived at their present view of reading as a school product. These results were produced by men who were interested in the problems themselves, rather than in their bearing upon the teaching of reading. For these reasons, much of this body of laboratory material lay unutilized for a period of years; but it may be expected that as both general and individual methods which are concerned with reading as a product are emphasized, teachers will be more interested in the processes which are fundamental to the act of reading.

FUNDAMENTAL DEFECTS IN READING ABILITY

An attempt will be made to summarize here deficiencies in reading ability, not in terms of attainment, but in a more fundamental way. To say that a child is a slow reader or poor in comprehension does not give fundamental causes; but if the defect can be stated in terms of the factors which determine rate or comprehension, then a basis is given for the solution of the problem. It is from this standpoint that the following discussion will proceed.

Defects in Perception. According to the preceding discussion there are two fundamental phases of perception. These are the width of the span of perception, and the ability involved in making accurate observations. If a low grade of ability in each of these abilities is found in a pupil, poor reading ability must result. In instances of this type interpretation can take place only in small units, which makes it inefficient as to rate. In addition to this, there would be an absence of accuracy. This would grow out of lack of ability to see those details which determine differences in words. If a short span of perception is combined with a high degree of ability to observe, the result is a slow reader who is certain of his results. The short span of perception makes for slow rate, but the accurate observations tend toward comprehension which is qualitatively efficient. If a long span of perception is combined with a small degree of ability in observation, inaccurate reading results. Under such conditions the long span makes for speed, but the lack of the second ability produces many inaccuracies.

Another type of defect is found in those pupils who are not able to use their full span in all types of reading. Cases have been noted where a wide span of perception was used in oral *reading* but not in silent reading, or *vice versa.*

Defects in Motor Ability. Reading requires the ability to acquire a number of complicated motor habits. There are those children whose chief difficulty seems to lie on the motor side of reading. Their reading shows extraneous movements, and the breathing coördinations are not well established. There may also be difficulties in pronunciation and enunciation, and eye-movement records may show gross irregularities and lack of rhythm. In other cases the difficulty takes the form of slow reactions.

Language Ability Lacking. Those phases of language ability which are involved in reading are highly complicated and may involve some of the highest forms of mental activity. There are children who seem to have great difficulty in gaining proficiency with language. These are the children who are reported by the teacher as not being able to recognize words or as having no appreciation of phrases, clauses, or sentences. To be sure, nearly every test or experiment which may be tried with such children will show unsatisfactory conditions in reading, but the fundamental factor in the entire situation is a lack of the appreciation of language. Such lack of appreciation is evidenced in their oral reading by gross mispronunciations, by the way they fail to heed all punctuation marks, and by the lack of phrasing. In such cases, there are few objective signs that there is appreciation of the meaning.

Lack of Ability to Attend. There are those children whose chief difficulty seems to lie in the effort which is put into the work. Of this type the teacher says that they could succeed if they would try. Others show very great fluctuations of attention. In so great a degree is this true of the reading of a few pupils that the term scatter-brained is not inapplicable when applied to them.

Defects in Other Higher Mental Activities. Details concerning these various processes are lacking. It is probable that some children develop a system of imagery which is too cumbersome. It is well known that assimilation may be slow, that the apperceptive processes may be too active, and that there may be an improper evaluation of the various ideas which enter into the material read.

Defects in Attitudes Toward Reading. It is clear that some children approach their reading with the wrong attitude. This may take the form of extreme carelessness or extreme overcarefulness.

TYPES OF READING ABILITY

The complexity of the reading process makes it difficult to classify readers into types or classes. The following descriptions cannot be considered as final, because other cases may be found which should be included in one of the various groups for reasons unknown at the present time. Other types may need to be added to those discussed here as more cases are studied. A tentative classification is of value because it aids much in the study of individual pupils.

Type I. *The Efficient Reader.* Such a reader shows his ability in both oral and silent reading. This means that such a pupil stands above the standard scores for the school grade to which he belongs in both types of reading. The perceptual ability of these children is such that there is a wide span, and the qualitative phases of material can be distinguished readily and easily. On the motor side, such children have established the necessary coördinations. The vocal movements as required in oral reading are well developed, while in silent reading these same movements are reduced to a minimum. The eye-movements have also been reduced to a minimum, and the length of each pause of the eyes is sufficient only for adequate interpretation. In addition to the foregoing, this type of reader has both a synthetic and an analytic knowledge of language forms and the necessary appreciation of language relations. From the standpoint of apperception, this group is able to employ a background of meaning and of experience in a highly efficient way. To be sure, not all of these factors are found in the same degree in different pupils, *but in general* the above description is in accord with the facts.

Type II. *The Confirmed Poor Reader.* Such readers are almost the exact antithesis of the type just described. They are inefficient in both oral and silent reading. By this is meant that pupils in this group are below standard scores in rate, comprehension, and accuracy. A study of perception as exhibited by such children shows a short span, and their errors in oral reading indicate clearly that they are not able to avail themselves of qualitative differences in material. On the motor side, the breathing coördinations are many times poorly established, and there may be many extraneous movements. The reaction time is slow, and the eye-movements are many, while the pauses involved in these movements are long. Further than this, there is a lack of analytical ability and little or no appreciation of language relations. Again, there are individual pupils in this group representing various degrees of ability, but nearly every teacher has come in contact with pupils of whom the above description is true.

However, neither of these types which are best understood and which can be best described presents the most serious problem to the teacher. Type I is composed of pupils who have mastered the technique of reading or who are well on the road toward such mastery. As a result, the problem of the teacher is to maintain their interest and their efficiency. For them the methods of the school are in most ways sufficient, and their success is assured. In their case, one of the chief problems is to find a sufficient supply of well-selected reading material. They should also be given correct ideals of rate, comprehension, etc., so that their development will not stop on a plane which is too low to be in accord with their general ability.

In an opposite way, Type II need not concern the teacher, because their efficiency can never be increased in any great degree. The pupils in this group probably lack native ability and would often be classified as dullards or border-line cases. They may be put into special groups and allowed to proceed more slowly than others in the class, but it is doubtful whether any special method or device can ever be discovered which will do more than place them a little above the illiterate level. Whenever it is possible, they should be examined by specialists, so that their special difficulty, if such exists, may be determined and proper training provided.

There are many children whose attainments in reading stand between the two extremes just discussed. Such pupils are not hopeless, so far as reading attainment is concerned, and yet they are not up to standards. They are efficient in some respects and inefficient in others. The remaining portions of this discussion are concerned with pupils of this general class.

Type III. *The Slow Reader.* The prevailing fault of those in this group is that they are slow. The accuracy and quality of their reading may both be satisfactory, except that it takes much longer for them to deal with a body of material than it should. On the perceptual side, these pupils have a short span, and though they are sensitive to differences in language forms as shown by their accuracy, the number of cues required to initiate recognition is either large or the time required for a few cues to function is long. On the motor side, there are frequent eye-movement pauses, most of which are long. There may or may not be extraneous movements present. Many times such reading is accompanied by a considerable amount of vocalization, and the breathing coördinations may or may not be well established. This type of reading may be due to seven causes.

First, the slowness may result from a lack of sufficient familiarity with the language forms. Many pupils of this type do not have the process of analysis so well established that it functions readily and easily. Again, the synthetic knowledge of words and phrases may not be on such a plane that recognition can take place quickly. Finally, there is a lack of appreciation for language relations. The cause of this may be a lack of reading. If the pupil had read more or would read more, the difficulty would in part, at least, be removed. Some children are deficient at this point because someone has always read to them, and as a result they have done little or no reading for themselves.

The second cause which leads to this type of reading is slow reaction time. In cases of this kind both the vocal muscles and the mental processes may function slowly. If such children try to hurry, they only make matters worse.

A third cause is found in the fact that some readers work at a low level of attention. They put little effort into what they are doing. As a result, what they do may be good in quality, but the amount done makes them very inefficient. Circumstances have never forced them to place their efforts on a high plane, and as a result their work continues to be inefficient from the standpoint of rate. Sometimes speed tests point out such students to the teacher and reveal the difficulty to the pupils themselves.

The fourth cause which leads to this type of reading is the fact that some pupils depend too much on the objective forms of language. Those who fall into this group have been described by Messmer as objective readers. The causes which lead to this method of interpretation are not well understood.

A fifth cause which gives rise to slow reading is over-care. Such readers may have been told in their early training that they must be slow and sure in their reading. Such a method may later become fixed.

The sixth cause to be mentioned is slow assimilative ability, while the seventh cause is a short span of perception.

It is clear from the preceding that the reasons for slow reading are varied. It will require very careful work on the part of the teacher if she determines in an accurate way the particular cause or causes which operate to make a child slow in reading.

Type IV. *The Rapid Reader.* This type of reader reads rapidly but interprets poorly. In silent reading such pupils cover considerable ground, but their comprehension is much below the standard. In oral reading their rates are apt to be entirely too fast, and their reading inaccurate. A study of this group shows that they have a long span of perception. The large number of errors which such children make in oral reading probably means that they are not sensitive to qualitative differences. It may also be that recognition is initiated by too few cues.

On the motor side, the eye-movement pauses are few and their duration very short. Indeed, it is highly probable that this type of reader often reduces both the number of pauses and their length below the limit where efficient reading can take place. Vocalization in silent reading is often scarcely perceptible, and extraneous movements are not present unless the child becomes confused and embarrassed. The breathing is, for certain pupils, jerky and proceeds in gasps. Their ability to deal with language forms and language relations is in most cases all that could be desired. Three causes for this type of reading may be cited. First, such pupils are often careless and indifferent about their work. They may have good ability, but have little regard for the results they obtain. Second, such reading may be a matter of temperament. If a reader is nervous, he may read in a manner which lacks thoroughness and which is done too rapidly for accurate results. The third reason is the fact that some readers do not depend in a sufficient degree upon objective factors. The subjective elements predominate in their reading process. The causes of this type of mental activity are little understood.

Type V. *Efficient Oral Reader, Inefficient Silent Reader.* There are a few pupils who are efficient oral readers, but who cannot deal with a passage of equal difficulty by means of silent reading. The eye-movements for such children in silent reading show that there are many pauses, which means that the reading is done in small units. This is due to two different causes. First, there are those readers who have never been able to differentiate in their methods between silent and oral reading. Their silent reading has almost the same number of eye-movement pauses as their oral reading, and vocalization is often present in a large degree. Again, their breathing curves may present the same form in silent reading as in oral reading. In other words, such silent reading has almost all elements of oral reading except the movements of the vocal chords. Silent reading of this type may be due to the fact that instruction in reading nearly always emphasizes oral reading. This means that a pupil is left to his own devices, so far as silent reading is concerned. Most readers succeed in establishing silent reading habits which are fairly successful, but that a few pupils should fail to do so is not at all surprising. Such children need to be taught silent reading.

The second cause for this type of reading is slow assimilation. In reading of this kind interpretation may be sufficiently rapid for oral reading but not so for efficient silent reading. This point is borne out by the fact that slow readers are often good oral readers. Such slow recognition may be due to natural ability, or it may be due to the fact that language forms have never been made sufficiently automatic. For the latter group the usual practice of the school is not sufficient to give a rapid and efficient recognition. They need drill which will place them on a higher plane, so far as recognition-time is concerned.

Type VI. *Efficient Silent Readers, Inefficient Oral Readers.* Again, there are some pupils who can read well silently, but who do poorly when they attempt to read orally. A study of the silent reading of such pupils shows that they are efficient in all the elements which enter into silent reading. In fact, not infrequently they are excellent readers from this standpoint, and evidently they try to carry over those methods which make for rapidity into their oral reading. As a result, their reading has in it many errors. Again, it is a case of not being able to differentiate between the methods of oral and silent reading. These pupils have developed a very efficient method of silent reading. Such a method gets results quickly and accurately

Under such conditions it is easy to see that some readers would not be able to use a slower and more cumbersome method, as required in oral reading.

RELATIONS OF THE VARIOUS PHASES OF THE READING PROCESS SHOWN IN OUTLINE FORM

In the outline given below, the relations of the various elements in the reading process are shown. Each element is numbered with Roman numerals. Under each of these, numbered with Arabic numerals, are placed those elements which may produce a deficiency in the elements numbered with the Roman numeral. To illustrate, Roman I is *Rate of Oral Reading*. Defects in this element may be produced by a lack of assimilative power, a slow rate of vocalization, lack of familiarity with language forms, a short span of perception, a lack of effort, over-care, and too great dependence upon objective forms. Theoretically, it is possible to have all these causes operating to produce a slow rate, and occasionally there may be found such a pupil, but usually only one or two causes are present, or it may be that one cause stands out more prominently than any other. It is this element which makes defects in reading ability hard to diagnose because the same defect in two pupils may have different causes. This condition of affairs always requires a careful study of the individual case. By looking further down the table, it is possible to determine the factors which make for slow rate of vocalization, lack of familiarity with language forms, etc.

In only one or two cases, is training mentioned. It is assumed that the defect exists after the usual training of the school has been given. However, in a few cases it was deemed wise to give faulty training as a factor which might lead to certain defects. Since the preceding discussion has dealt with each of the points mentioned in the outline, further consideration is not thought necessary.

Outline Showing Relation of Factors in Reading Process

I. Rate of Oral Reading
  1. Lack of Assimilative Power
  2. Slow Rate of Vocalization
  3. Lack of Familiarity with Language Forms
  4. Short Span of Perception
  5. Too Great Dependence upon Objective Cues
  6. Too Great Care
  7. Lack of Effort

II. Rate of Silent Reading
  1. Faulty Eye-Movement
  2. Lack of Assimilative Power
  3. Large Amount of Vocalization
  4. Lack of Familiarity with Language Forms
  5. Short Span of Perception
  6. Lack of Effort
  7. Too Great Care

III. Omissions in Oral Reading
  1. Fields of Perception do not Overlap
  2. Reading from Context
  3. Fluctuations of Attention

IV. Repetitions in Oral Reading
  1. Habitual
  2. Dissatisfaction with First Attempt
  3. Too Great Overlapping in the Field of Perception

V. Insertions in Oral Reading
  1. Reading from Context
  2. Fluctuations of Attention
  3. Apperceptive Processes too Active

VI. Mispronunciations in Oral Reading
  1. Faulty Perception
  2. Lack of Familiarity with Language Forms
  3. Speech Defects
  4. Apperceptive Processes too Active

VII. Substitutions in Oral Reading
  1. Reading from Context
  2. Faulty Perception
  3. Apperceptive Processes too Active

VIII. Quality of Oral Reading
  1. Failure to Appreciate Language Relations
  2. Lack of Training
  3. Lack of Assimilation

IX. Comprehension
  1. Slow Assimilative Power
  2. Failure to Evaluate Different Ideas Properly
  3. Poor Motor Adjustments
  4. Short Span of Perception
  5. Lack of Language Ability
  6. Lack of Synthetic Ability
  7. Lack of Analytic Ability

X. Faulty Eye-Movements
  1. Short Span of Perception
  2. Periods of Confusion
  3. Poor Motor Coördination

XI. Breathing
  1. Nervousness
  2. Poor Motor Coördinations
  3. Habitual
  4. Lack of Training

XII. Rate of Vocalization
  1. Slow Reaction Time
  2. Lack of Familiarity with Language Forms

XIII. Amount of Vocalization
  1. Habitual
  2. Accompaniment of Meaning

XIV. Extraneous Movements
  1. Nervousness
  2. Habitual
  3. Lack of Adjustment to Reading Situation

XV. Vocal Movements
  1. Habitual
  2. Defects in Speaking Parts

XVI. Span of Perception
  1. Faulty Training
  2. Slow Assimilation
  3. Low Level of Attention

XVII. Voice-Eye Span
  1. Faulty Training
  2. Slow Assimilation
  3. Low Level of Attention

ANALYSIS AND SYNTHESIS

The relation of the various phases of reading ability may be brought out in still another way. Let it be assumed that all these factors are well developed, and that the reading mechanism is in smooth running order so that each of the previously discussed factors plays its part in an efficient manner, and the final results of reading are attained easily and smoothly. Such a combination of factors into a single process results in definite methods of approach to the meaning of printed material. One of these methods is analysis and the other is synthesis.

Synthesis is a rapid, immediate, and direct process. Such a process of recognition is usually found in connection with material which is easy and familiar. It is probably true that all the letters of the alphabet are recognized in this manner by the trained reader, and that most syllables and words of three or four letters are dealt with in the same manner. Doubtless, many of the longer words with which one is very familiar do not require analysis. In the same way, phrases and short sentences may be apprehended by synthesis. However, if a trained reader is confronted with new words, even though they be short, the synthetic process breaks down and other methods are required. Another element which makes synthesis difficult in certain cases is that many of our words are very similar in appearance. However, the synthetic method of reading should be the final and ultimate goal of all reading instruction, but such method of dealing with language forms must be supplemented by other methods which are to function when the synthetic processes fail the reader. There are certain difficulties which attach to the synthetic methods which should be emphasized.

Some pupils seem to approach all language by synthetic processes, but since this method is not sufficient to meet all situations which arise in dealing with language, they are inaccurate in their interpretation of words and other language forms with which they are not familiar. When such readers come in contact with new words, they are satisfied if they can get the meaning from the context. If the pronunciation is difficult the word is skipped. Such readers seldom distinguish between words which are similar in form or in sound, and they may be embarrassed many times by such mistakes. This attitude can well be characterized as slovenly and careless. It should be discouraged by all teachers of reading.

The analytic process stands opposed to synthesis. It is a mediate process, somewhat indirect in its nature and relatively slow in its procedure. One type of analysis with which the child comes in contact very early in his training in reading has to do with letters. Certain letters are very much alike, and it becomes necessary for the pupil to note carefully the differences which exist between them. A second type of analysis required of the child is to be found in phonics. The oral experience of the child with language is highly synthetic. Printed language is of such a nature that progress in it requires some understanding of the laws and principles which underlie the parts into which words are divided. This type of analysis is required because the various sounds which go to make up the oral word are represented by letters and syllables. The ability to make use of the laws and principles of phonics seems to exist on various levels. At first, it is a somewhat slow and tedious oral process. Later, all the work of this type can be done mentally, and still later it develops into an analytical attitude towards all language. Again, analysis is required in the study of language relations. Language is complex, and if comprehension in reading is to take place readily and easily, a knowledge of these various relations is necessary.

Analysis may also be a phase of the perceptual process. This is to be seen in the recognition of similar words and in the recognition of difficult or unfamiliar words. The nature of this process is not well understood, but it seems to be fundamental to much reading. A study of eye-movements shows clearly that the analytical process ceases to function on certain occasions. This may result in periods of confusion. Under such conditions the reading process is always very much delayed, and in other cases it may break down entirely.

There are also certain dangers which may arise from the analytical method of attack to which attention should be called. It becomes so fixed in the mental activity of some pupils that it almost entirely supersedes the synthetic process. This predominance of the analytic method may be produced by overemphasis upon small units of meaning during the early training period. It results in overcareful and very slow work. Extreme forms of the analytic method are to be avoided, and care should be exercised by teachers to see that children do not develop them. It is evident that the efficient reader must use both the synthetic and analytic methods, but the analytical method should never become the prevailing method. It is only a reserve method which is to be brought into use upon certain occasions.

A COMPARISON OF ORAL AND SILENT READING

It is the purpose now to summarize the data which have been presented upon this problem in such a way as to make more definite the contrast between the two types of reading. The results for eye-movements have shown that oral reading requires more pauses than does silent reading, and that the units by which material is interpreted in silent reading are very different from those by which material is interpreted in oral reading. To get meaning by means of small units as required in oral reading requires a definite mental set and a definite form of mental activity; and to get it by the large units of silent reading requires quite a different mental set and a different form of mental activity. For the keen, alert, and well-trained reader the first may be the difficult method, while for the poorly trained or slow reader the second is, without doubt, the difficult method.

The objections to the short units of interpretation from the standpoint of the good reader are easy to see. First, they make interpretation slow. If the reader is interested and anxious to push on through the reading matter, he is held back by having to deal with small units. Hence, he loses patience and may lose interest. In many cases the voice-eye span extends over several words. Every trained reader can testify to the tantalizing effect of this phase of oral reading. It requires considerable patience to have a group of words already interpreted and dangling before one at all times during the oral reading activity. Under such conditions it is difficult to refrain from pushing ahead rapidly into the passage.

In the second place, small units may be hard to deal with. It is clear that each unit has to be related to that which follows it. Therefore the more units, the more relating to be done. This choppy way of dealing with material is very irksome to some persons.

In the third place, the small units may be difficult because the habit of dealing with large units is firmly fixed and the reader finds it hard to change to methods involving small units. The habit of using large units as a basis of interpretation may become so thoroughly the prevailing method that the use of any other method is almost precluded. The attempt to impose oral reading upon a child in the upper grades who has acquired the rapid methods of silent reading is to expect a difficult performance, for his entire mental machinery is habituated to the rapid methods.

The chief objection to the small unit of interpretation from the standpoint of good teaching is that it makes for mental lethargy. There is no opportunity for the reader to work up to his limit, and as a result he becomes habituated to and satisfied with slow methods. This is probably the most pernicious habit to which poor training in reading may lend itself. The alert pupil may develop an attitude toward all reading which leads him to be satisfied with slow methods and with working upon a low level of effort. These points serve to emphasize the fact that if oral reading is continued too long, as the child proceeds from grade to grade, there is the possibility of fixing definitely the method of interpreting by small units.

Another difference existing between oral and silent reading is that which relates to the number of motor elements involved in each. In oral reading such elements are necessary and are involved in considerable numbers. In silent reading, with the exception of eye-movements, they are eliminated.

The discussion thus far seems to warrant the statement that there are in oral and silent reading two separate and distinct habits. Each of these has its mental set, its method of interpretation, its perceptual processes, and its motor habits. To make this point clearer, an example of a different character may be given. If a person works at a desk with two similar ink wells before him, one at his right and the other at his left, he can soon establish the habit of dipping his pen into the ink well to the right at all times and under all circumstances. If he is required to cease dipping his pen in the right-hand well and to dip it into the left-hand well, the new habit is soon so well established that no mistakes are made. Münsterberg has shown that in a case of this sort one may develop first one of the habits and then the other until it is possible to decide which habit one cares to use, and after the decision is made, one may use the habit selected without errors.

The case of the child in reading is not unlike this. He first builds up the habit of oral reading, and then is called upon to develop the habit of silent reading. Though much of the reading of the school is oral, yet the child is expected to change to silent reading on a moment's notice. The study of the child in reading is carried on silently, but his recitations in this subject are usually oral. Here is a transfer from one habit to another. The child has to develop two distinct habits of reading, and has to be able to change from one to the other instantly. Adults who read silently on most occasions make the change to oral reading in a clumsy and awkward fashion, while those persons who read a great deal of poetry orally have difficulty in reading such material silently. In other words, the child is expected to do what the adult has difficulty in doing. This view of the two types of reading suggests important problems in training.

The Reading of Adults Compared with the Reading of Children

The final standpoint from which the summary is to be made is a comparison of the reading of adults and of children. The study of eye-movements has shown important likenesses and differences in the reading of each of these types of readers. Adults reduce the number and length of their eye-movement pauses to a minimum. In such reading the regressive movements are infrequent and short. This means that such reading proceeds in units for which interpretation is seldom lacking, and that when recognition does fail to take place, a quick recovery is made. If records B and C in Figure 11 are examined in this connection, one is impressed with the regularity of the movements. It is true that this regularity disappears in certain lines, but for the most part the reading is done in a rhythmical manner. Dearborn was the first to call attention to this element in adult reading. He held that if lines were of equal length and the material homogeneous, the eye tended to take on a brief motor habit. The fundamental factor in such a habit is the unconscious process by means of which the points where the eyes are to stop are determined. The experimental evidence upon this point indicates that this process depends in a large measure upon the ability to anticipate meaning. In the case of the trained reader the anticipation of meaning can be accomplished in easy and familiar material without difficulty. The fact that rhythm disappears in difficult or strange material indicates that the anticipation of meaning which is almost entirely absent in reading of this type plays its part in the location of the various eye-movement pauses.

The discussion of peripheral vision and the cumulative effects of eye-movements has shown clearly that a long span of perception allows a partial interpretation of the material which is to come. It has also been pointed out that a knowledge of language relations gives a partial interpretation. Another factor which lends itself to the same end is apperception. It is clear then that these three factors are very important factors in establishing the rhythmical character of adult reading, in that they aid in determining the points of fixation through anticipated meaning.

Another problem involved in rhythmical reading, as just described, is the unit by which it proceeds. These units vary from individual to individual. A fundamental question involved is why one person uses one unit as a basis for his reading, and another with equal training and equal ability makes use of a very different one. One cause for this difference is, without doubt, to be expressed in terms of mental effort. The level on which the work of most persons proceeds is probably a fundamental characteristic of their mental activity. This characteristic leads the person to start his reading in a unit of a certain length, and as experience is gained this unit establishes itself.

Efficient adult reading may now be contrasted with the efficient reading of children. The reading portrayed in Figure 11 was said to approach the adult type. Schmidt has called attention to the fact that the reading of children is more erratic than that of adults. These erratic phases were shown in the number and length of regressive movements. Such movements indicate that the points at which the eye-movement pauses are located have not been determined accurately. That is, the reading of the child does not have the same rhythmical character as adult reading. From this standpoint, the child has not reached the place in his experience where the partial interpretations of peripheral vision or of language relations or of apperception function in his reading, as they do in the case of the adult. Another factor is that the child has not definitely established the unit in which his reading is to proceed, and experience has not given him facility in the use of such a unit.

The fundamental difference between adult and child reading is found, then, in the element of rhythm. In all other respects he may approach adult reading, but in the use of those three fundamental factors which give rhythm to his reading he needs experience and training. In addition to this, the child has not definitely established a unit for his interpretation of material. It is probably true that many of the problems for efficient instruction in reading center about these various factors.

PART II

A COMPILATION OF TESTS AND METHODS OF OBSERVATION FOR DIAGNOSTIC PURPOSES

CHAPTER XVI

SILENT AND ORAL READING TESTS TO BE USED FOR THE PURPOSE OF DIAGNOSIS

INTRODUCTION

The discussion of the preceding chapters has been given over to an analysis of the reading process. The problem of diagnosis requires, next, that methods be provided by means of which the presence or absence of the various elements in the reading of any individual pupil may be determined. The attempt is made to bring together all the material needed for such work in a way that will save as much time as possible for the teacher. The plan is so arranged that the diagnosis can be made fairly complete or it can be made less complete, just as the case demands. The methods available for carrying out this diagnosis involve tests and observations. Along with the compilation of these will go directions for using the various tests and for making the different types of observations. Directions will also be given for scoring results and for recording the scores obtained by the methods outlined. Finally, the resulting scores will be interpreted in such a way as to serve as a basis for remedial work.

Apparatus Needed. The plan outlined here requires three pieces of simple apparatus. These are a stop watch,[1] a short-exposure apparatus, and a mirror. If the stop watch is not available, any watch with a second hand can be used; and if the money with which to buy a short-exposure apparatus cannot be had, a simple apparatus may be made from working drawings given later in the discussions. These drawings will enable a local carpenter, or boys in manual training, to construct this apparatus.

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[1] These forms of apparatus may be had from C. H. Stoelting, Chicago.

General Methods of Procedure. The plan as outlined in the following pages is based upon individual testing. The first step is to give Monroe's silent reading test. This is to be followed by Gray's oral reading test. A careful study of the results of these tests will indicate whether it is necessary to use other tests of a similar type. If additional tests are necessary, they may be selected from the supplementary tests which are provided. Careful study on the part of the examiner will be necessary in order to determine which test or tests will apply to the case at hand. In most instances this will not be difficult, and the study will become more interesting as more data are procured.

An examiner who is inexperienced in such work should not undertake to study in the detailed way outlined here more than two or three children at any one time. Work of this type should be undertaken as a definite problem. Conferences should be held with supervisors or principals, and the scientific literature upon the problems of reading should be studied. Problems of this kind should not be rushed. All directions should be studied carefully, so that the meaning of each test and experiment may be understood. If these general directions are followed, the work will be of advantage to both teachers and pupils.

A Coöperative Plan of Procedure. In certain schools a number of teachers may wish to coöperate in their study of pupils. In such instances, it may be well for one or two teachers to take charge of all the silent reading testing which is to be done; a second group may study carefully and be responsible for the oral tests; a third group may assume responsibility for the perception tests; and still a fourth group may give the motor tests.

Such a plan saves any one teacher the necessity of studying in detail all the different types of tests and also gives any group of teachers greater opportunity for study and work upon the particular type of test for which the group is responsible.

This method also makes possible the careful study of a considerable number of pupils. From this number each teacher should select three or four for the remedial work. After these are selected, a conference of each teacher with every other teacher who has helped in the diagnosis should be held before the remedial work is begun.

Plan of Procedure for Principals and Supervisors. In some instances principals will desire to undertake such work as a school project. The first step in such a procedure should be the enlistment of the coöperation of the teachers who are to have charge of the pupils studied. If emphasis is placed upon the fact that the ultimate end of the method is the study of individual pupils, most teachers will immediately show an interest. If the interest of the teachers is properly aroused, the coöperative plan, as outlined before, may be followed.

THE SELECTION OF PUPILS

The Group Method. An important matter upon which the success of the method depends is the proper selection of the pupils to be studied. If it is desired to deal with any considerable number of children, it will be necessary to use the group method of selection. This consists in giving the Monroe silent reading test to all pupils under the charge of the teacher who is to be immediately responsible for the diagnosis and remedial work. When this test has been scored, all pupils who fall below the school median may be selected for further consideration. Some of those whose score is low will probably be so backward in all their school work that they may be eliminated from the number. Experience has shown that in most cases about one third of the class will be listed for further study. From this point forward the work must be carried on as an individual matter. This plan of procedure has been used with success by those who are experienced in such work. The only difficulty involved is the large number of pupils for whom the detailed work of diagnosis is required.

The Individual Method. For those who are inexperienced, the individual method of selection is urged. This consists in selecting one or two children for intensive work. If the one interested in starting the project is a teacher, she may select one or two pupils from her own grade. If the one interested in the work is a principal, he should select teachers to carry on the diagnosis who have some training in psychological procedure and who are best adapted to such work. Each teacher should then select one or two children for special study. The pupils who are of interest in this connection are those who have special difficulty with reading. The following description of a typical case by Judd may be cited at this time.

> The girl, case G, entered the first grade of the Elementary School of the University of Chicago when six years and two months old; left the city at the end of the year; entered the second grade in the public school of a small town in a neighboring state; returned to Chicago again after a year's absence and entered the low third grade of the public schools of Chicago. In the middle of the same year she reëntered the University Elementary School in the high third grade.
>
> The school physician's record shows that she is a normal, healthy child, with no special defects in eyes, ears, or throat. She was absent sixteen days during her two and a half years in this school; eleven of these absences were in Grade 1a. She is very slow in movements but responsive in her reactions when especially interested.
>
> She is rated by her teachers as a good student in subjects other than reading. Her school record in handwork, drawing, penmanship, and mathematics is very good (B and A), and good (B) in history, geography, and science. In reading, however, she has stood consistently at C or D from the first through the fourth grade.
>
> Reading seems to be her greatest weakness. Her fourth grade teacher reported her as "a slow reader who reads hesitatingly and haltingly, repeating words and phrases. Her breathing is very shallow, often causing her to pause for breath in the middle of a word or phrase. Her voice is thick, heavy, and unpleasantly nasal. Silent reading is particularly distasteful to her. She always settles down to it reluctantly and tardily."
>
> From her home comes much the same story. "She has never read a story to herself, though she has several attractively illustrated children's books. She frequently, however, after eagerly studying the illustrations in a new book, begs to have the story read to her, saying, 'You read it, mother. I can't understand it very well when I read it myself.'"

It should be emphasized again that the study of children who are mentally deficient or who are very poor in all studies will only take the time and energy of the teacher and will avail little. Such cases are already diagnosed in so far as the regular teacher can deal with them. They are subjects for specialists. If there are those about whom the teacher cannot be sure, she may use the present methods in order to determine their status more definitely.

After the selection of the children is made, the plan set forth on the following pages may be used. This method has been arranged for individual work and not for group testing.

Number of Tests to be Used. An important problem at this juncture is the number of tests and observations necessary for making a diagnosis. A general rule which may be followed is: Continue to give tests and to make observations until the case is understood. This does not mean that the work should proceed in a blind way, but that each test given or observation made should suggest another type of test or observation and so on until a solution of the case is reached. In some instances an understanding of the pupil's difficulty may be reached after two or three tests have been made, while in other instances it may be necessary to use most of the tests and observations listed in the pages which follow. This phase of the problem will become easier as experience is gained in the work.

STANDARDIZED SILENT READING TEST

Devised by Walter S. Monroe

This test is given for the purpose of determining the child's rate of reading and his ability to comprehend, as indicated by answers to questions upon a series of selections of increasing difficulty. It probably represents a specialized type of reading, but it is used here for the purpose of giving a general index of reading ability. It should be given to all children who are studied in this manner.

General Directions for Giving the Test

1. The pupil should be tested individually in a quiet place where he will be free from distraction.

2. Time should be taken to get the pupil in the right frame of mind toward the work. If the examiner is the regular teacher of the pupil, only a few explanations concerning the tests are necessary. Usually the children who are to be studied in this intensive way are those who have difficulty in their reading. If this be true, the teacher can speak of the test as extra drill which will probably increase the efficiency of the pupil's reading. The work should never be spoken of as a test unless the child is accustomed to taking tests and has learned not to be confused by such work.

If the examiner is from outside the school, a somewhat different attack must be made. The author has found that a statement such as the following is effective: John (examiner will substitute correct name) your teacher (or principal) has reported to me that you have difficulty with your reading. She (or he) has asked me to try to help you with some of these difficulties. I have been able to help other boys and girls, and if you will work hard and do just what I tell you probably I can be of some assistance to you. Are you willing to work with me in this matter?

3. Time can be kept much better with a stop watch than with an ordinary watch. If a stop watch cannot be had, any watch with a second hand may be used.

4. The observations upon "amount of vocalization" should be made while the silent reading tests are being given. See the directions for making such observations under the directions for the motor tests on page 317.

5. Watch for extraneous movements. See directions on page 318.

6. Have the child fill in the blank at the beginning of the test with his name, age, grade, and so forth.

7. Score this test according to the directions on page 329. Record the results in the proper place on page 341. See directions for interpretation in Chapter XX.

SUGGESTIONS UPON INTERPRETATION OF RESULTS

a. Is the pupil poor both in rate and comprehension, or does one of these factors seem much more pronounced than the other? If the pupil is slow, the speed test given later in the chapter may be tried. If comprehension is poor, the eye-movements may be observed for periods of confusion and regressive movements.

b. Did he work as though he knew how to proceed?

c. If not, did he fail to understand the directions?

d. Did he put his whole effort into the work? If not, try the speed test.

e. Does the result of the test correspond with your general estimate of his ability? If not, try one or more tests in the supplementary list given in the latter portion of this chapter.

f. Study the test sheet to see if you can detect the pupil's difficulty.

8. The next step in the procedure is to give the Gray Oral Reading Test.

For Grades 3, 4 and 5

City..................*State*.............*Date*..............
Pupil's Name..........*Age*................*Grade*.........
School................*Teacher*...........................

Instructions to be Read by Teacher and Pupil Together

This brief test is given to see how quickly and accurately pupils can read silently. To show what sort of test it is, let us read this:

> I am a little dark-skinned girl. I wear a slip of brown buckskin and a pair of moccasins. I live in a wigwam. What kind of a girl do you think I am?
>
> Chinese French Indian African Eskimo

The answer to this exercise is "Indian," and it is to be indicated by drawing a line around the word. The test consists of a number of exercises like this one. In some of the exercises you are told to draw a line around the word which is the right answer or to mark it in some other way, and in some you are to write out your answer. If an exercise is wrong it will not count, so it is wise to study each one carefully until you know exactly what you are asked to do. The number of exercises which you can finish thus in five minutes will make your score, so do them as fast as you can, being sure to do them right. Stop at once when time is called. Do not open the papers until told, so that all may begin at the same time.

The teacher should then be sure that each pupil has a good pencil or pen. Note the minute and second by the watch and say, BEGIN.

Allow Exactly Five Minutes When time is up, say STOP.

No. 1

Rate Value 8

"I am not playing, little girl," said the squirrel. "I am running to my home in the hollow tree. Don't you hear my babies calling me? I must feed them."

Where was the home of the squirrrel?

In the..................

Comprehension Value 1.3

No. 2

Rate Value 7

The little Pilgrim girls carried their work boxes to the dame-schools and learned to sew and knit as well as to read and write.

Where did the girls go with their work boxes?

To the.................

Comprehension Value 1.3

No. 3

Rate Value 7

When the white men first came to this country they found the red men, or Indians, living in wigwams, made of long poles and covered with skins.

Which people lived here first, the white or red?

....

Comprehension Value 1.3

No. 4

Rate Value 9

Hiawatha was a little Indian boy. He had no father and no mother. He lived with his grandmother, Nokomis. His home was in a wigwam.

Draw a line under the word that tells whom Hiawatha lived with.

father aunt mother uncle sister grandmother

Comprehension Value 1.4

No. 5

Rate Value 6

The cabin of Uncle Tom was a small log building close adjoining to "the house," as the negro designates his master's dwelling.

Of what material was Uncle Tom's cabin built?

....

Comprehension Value 1.4

No. 6

Rate Value 7

A crab who lived in a sand-hill was sitting at his door in the sun eating a rice cake. An ape went by, carrying an orange seed.

Where did the crab live?........................

Comprehension Value 1.5

No. 7

Rate Value 10

In the western part of the United States there are large tracts of land known as deserts. On these deserts one may travel for scores of miles without seeing vegetation of any kind excepting cactus and scattered blades of grass.

Would you expect to find many trees in these deserts?......................

Comprehension Value 1.7

No. 8

Rate Value 5

Spring is the time for planting seeds. They grow fastest in summer. Autumn is the harvest time

When are seeds put into the ground?.............

Comprehension Value 1.8

No. 9

Rate Value 8

The mother stork sat in her nest with her four little ones. At a little distance, on the top of the roof, stood the father stork. He held one leg up and stood on the other.

Where was the father stork?...................

Comprehension Value 2.0

Rate Value 9

No. 10

Six white eggs on a bed of hay
Flecked with purple, a pretty sight!
There as the mother sits all day
Robert is singing with all his might.

The above lines of a poem tell about a bird's nest. Of what was this bird's nest made?

....

Comprehension Value 2.3

Rate Value 11

No. 11

The carp is a fish that lives in the rivers of Japan; it can leap high out of the water and jump over rocks; it can even leap over waterfalls, and swim against a strong current. If you think the carp is a strong fish, draw a line under the word "carp"; if not, draw a circle around it.

carp

Comprehension Value 2.5

Rate Value 11

No. 12

At last, by despair and by famine made bold,
All dripping with wet and all trembling with cold,
The cricket crept off to the miserly ant.

If you think this cricket was happy, draw a line under the word "happy," but if you think he was unhappy, draw a line around the word "unhappy."

happy unhappy

Comprehension Value 2.7

Rate Value 10

No. 13

In order to live in Holland the people have built dikes, to keep the sea out, and have dug canals to drain the land. The water that collects inside the dikes is pumped out by windmills.

Draw a line under the word below that which most nearly describes the land in Holland.

mountainous low desert high

Comprehension Value 2.7

No. 14

Rate Value
10

We shall pay a visit to the frogs. They will bow to us and sing "Croak, croak," and we shall eat them. Then we shall fly away to a warm country.

In this paragraph the old stork is talking to the young ones. What does she say the frogs will sing?

....

Comprehension Value
2.9

No. 15

Rate Value
9

A silly young cricket, accustomed to sing
Through the warm, sunny months of gay summer and spring,
Began to complain, when he found that at home
His cupboard was empty, and winter had come.

Draw a line under the word which best describes the cricket.

wise faithful foolish proud prudent

Comprehension Value
3.0

No. 16

Rate Value
14

By the sound of the birch he urged some tardy loiterer along the flowery path of knowledge. Truth to say he was a very conscientious man and ever bore in mind the maxim, "Spare the rod and spoil the child."

Ichabod Crane was a school teacher. If you think he spoiled his scholars, draw a line under rod; if he did not, draw a line under child.

rod scholars child teacher

Comprehension Value
3.5

For Grades 6, 7, and 8

City.................*State*.............*Date*.............

Pupil's Name..........*Age*.............*Grade*............

School................*Teacher*.........................

No. 1

Rate Value 5

Oil floats on water because it is lighter than water. Milk mixes with water because milk and water are of equal weight.

Which is lighter, oil or milk?...................

Comprehension Value 2.0

No. 2

Rate Value 7

At evening when I go to bed
I see the stars shine overhead;
They are the little daisies white
That dot the meadow of the night.

What are the little white daisies of the night?

....

Comprehension Value 2.1

No. 3

Rate Value 7

O suns and skies and clouds of June,
And flowers of June together,
You cannot rival for one hour
October's bright blue weather.

Which month does this stanza say is the more pleasant?

....

Comprehension Value 2.8

No. 4

Rate Value 8

They rested and talked. Their talk was all about their flocks, a dull theme to the world, yet a theme which was all the world to them.

What do you suppose was the occupation of these men?

carpenter doctor merchant shepherd blacksmith

Comprehension Value 2.7

No. 5

Rate Value 4

Africa is smaller than Asia, and North America is not as large as Africa. Which is smaller, Asia or North America?

....

Comprehension Value 2.8

No. 6

Rate Value 12

The dog lay down. The rooster flew to the top of a tree and the cat climbed to one of the branches. Before they went to sleep the rooster saw a light in the forest. He called to his friends.

Where was the light the rooster saw? Draw a line around the word that tells where.

sky house barn wagon forest

Comprehension Value 3.4

No. 7

Rate Value 11

He was a wicked ruler, who, with his still more wicked sons, oppressed and wronged the people in many ways.

If he people would be sorry when the ruler and his sons died, draw a line under the word ruler; if they would be glad, cross out the word ruler.

ruler

Comprehension Value 2.0

No. 8

Rate Value 15

He said to his friend: "If the British march
By land or sea from the town tonight,
Hang a lantern aloft in the belfry-arch
Of the North Church tower, as a signal light,
One if by land and two if by sea;
And I on the opposite shore will be
Ready to ride and spread the alarm."

If the British came by land, how many lights did the man see in the church tower?

....

Comprehension Value 3.0

No. 9

Rate Value 12

The higher you go the colder the air is. Cold condenses moisture and causes it to fall as rain. The wind in our western states blows from the west across the Rocky Mountains.

Would you expect it to be dry or wet east of these mountains? If dry, draw a line under air; if wet, draw a line under rain.

air rain

Comprehension Value 3.4

No. 10

Rate Value 17

It was cold, bleak, biting weather; foggy withal; and he could hear the people in the court outside go wheezing up and down, beating their hands upon their breasts and stamping their feet upon the pavement-stones to warm them.

The author has attempted to give you a picture in this paragraph. After reading the paragraph, if you think it is a picture of comfort and pleasantness, draw a line under the word hear; if of cheerlessness and dreariness, draw a line under bleak.

hear wind bleak cold

Comprehension Value 4.3

No. 11

Rate Value 10

The boy stood on the burning deck,
  Whence all but he had fled;
The flame that lit the battle's wreck,
  Shone round him o'er the dead:
Yet beautiful and bright he stood,
  As born to rule the storm.

Draw a line under the word that best describes the boy.

cowardly mischievous brave young good

Comprehension Value 3.6

No. 12

Aladdin's uncle said: "I will take a shop and furnish it for you." Aladdin was delighted with the idea, for he thought there was very little work in keeping a shop. He liked that better than anything else.

Draw a line under the word below that tells us what kind of a boy Aladdin was.

industrious ambitious active lazy honest

Rate Value 11

Comprehension Value 4.1

No. 13

Not far from Greensburg is a little valley, among the high hills. A small brook glides through it, with just murmur enough to lull one to repose; and the occasional whistle of a quail, or tapping of a woodpecker, is almost the only sound that ever breaks in upon the uniform tranquillity.

What kind of a picture do you get from reading the above paragraph?

disorder activity noise calmness confusion

Rate Value 14

Comprehension Value 4.4

No. 14

The soldier crawled out of the trench, where he had spent the night. He was covered with mud from head to foot, and almost frozen. He looked around at his companions. What a miserable lot they were! This, then, was the glorious war told about in the papers.

Draw a line under the word below that tells how the soldier felt.

happy patriotic brave angry downhearted

Rate Value 13

Comprehension Value 5.4

STANDARDIZED ORAL READING TEST

DEVISED BY WILLIAM S. GRAY

This test is given for the purpose of determining the pupil's oral rate and his ability to deal with words in context. It will give a definite idea of the child's vocabulary and his adjustment to the reading process. It should be given to all pupils who are dealt with from the standpoint of diagnosis.

DIRECTIONS FOR GIVING THE TEST

1. The same general plan should be followed as in the preceding test.
2. The child should be made to understand that this test is a continuation of the work which preceded and thus be put at his ease.
3. The child must be supplied with a copy of the test. See that the cover pages are cut at the proper places in the copy that the child uses.
4. In order to get the time as accurately as possible with a stop watch, notice the child as he turns the cover page and snap the watch just as he starts to speak the first word. If an ordinary watch is used, say "ready" just before the second hand comes to some convenient point. The child then turns the cover page and just as the hand reaches the predetermined point the examiner says "begin."
5. Record the time for each passage in the places designated on the margin at the right in the copy which you use.
6. In recording errors the following set of symbols may be used:

a. ∧ means insertions.

b. *O* means omissions.

c. A word or part of a word underlined means a mispronunciation.

d. A word or phrase underlined with an "*R*" above indicates a repetition.

In order to illustrate clearly the character of errors and the method of recording them, the following paragraph is quoted from Gray's work:

The sun pierced into many my large windows. It was the opening of October, and the clear sky was of a dāzzling blue. I looked out of my window and down the street. The white houses of the long, straight street were almost painful to the eyes. The clear atmosphere allōwed full play to the sun's brightness.

"If a word is wholly mispronounced, underline it as in the case of 'atmosphere.' If a portion of a word is mispronounced, mark appropriately as indicated above: 'pierced' pronounced in two syllables, sounding long *a* in 'dazzling,' omitting the *s* in 'houses' or the *al* from 'almost,' or the *r* in 'straight.' Omitted words are marked as in the case of 'of' and 'and'; substitutions as in the case of 'many' for 'my'; insertions as in the case of 'clear'; and repetitions as in the case of 'to the sun's.' Two or more words should be repeated to count as a repetition.

"It is very difficult to record the exact nature of each error. Do this as nearly as you can. In all cases where you are unable to define clearly the specific character of the error, underline the word or portion of the word mispronounced. Be sure you put down a mark for each error. In case you are not sure that an error was made, give the pupil the benefit of the doubt. If the pupil has a slight foreign accent, distinguish carefully between this difficulty and real errors."

7. You should also evaluate the following points concerning the oral reading: poise, pitch, interpretation, articulation, pronunciation, emphasis, and force. For more specific directions upon these points, see the directions for scoring, page 333. It may be well to estimate these points from the daily work of the child.
8. Watch for extraneous movements. See page 318.
9. Have the child fill in the blanks for age, grade, etc.
10. Score the test according to the directions on page 331, and record the results as indicated on page 342. It should be noted that a record sheet is provided for the various types of errors.

SUGGESTIONS UPON INTERPRETATION OF RESULTS

1. Is the rate slow? If such slowness seems to be due to a lack of vocabulary, try the vocabulary test. If there seems

to be no lack of vocabulary, try the test for rate of vocalization and span of perception.

2. Does the child indicate that he understands what he reads? If not, observe his eye-movements.

3. Is he lacking in word knowledge? If doubtful, give the vocabulary test.

4. Does he have an appreciation of language relations? If doubtful, give the Trabue language test.

5. Study the various errors by means of the outline on page 348.

Name......................*Grade*.........*Age*..........

Date.............

DIRECTIONS TO THE PUPIL:

On a few of the pages which follow this there are some short prose selections. I want you to read them *orally*. Read as you do when you are called upon by your teacher to read. If you should find some hard words, read them as best you can without help and continue reading. *Do not turn any pages until I ask you to do so.*

I

A boy had a dog.
The dog ran into the woods.
The boy ran after the dog.
He wanted the dog to go home.
But the dog would not go home.
The little boy said,
"I cannot go home without my dog."
Then the boy began to cry.

Time.......

2

Once there were a cat and a mouse. They lived in the same house. The cat bit off the mouse's tail. "Pray, puss," said the mouse, "give me my long tail again."

"No," said the cat, "I will not give you your tail till you bring me some milk."

Time........

3

Once there lived a king and queen in a large palace. But the king and queen were not happy. There were no little children in the house or garden. One day they found a poor little boy and girl at their door. They took them into the palace and made them their own. The king and queen were then happy.

Time........

4

Once I went home from the city for a summer's rest. I took my gun for a stroll in the woods where I had shot many squirrels. I put my gun against a tree and lay down upon the leaves Soon I was fast asleep dreaming of a group of merry, laughing children running and playing about me on all sides.

Time........

5

One of the most interesting birds which ever lived in my bird-room was a blue jay named Jakie. He was full of business from morning till night, scarcely ever still. He had been stolen from a nest long before he could fly, and he had been reared in a house long before he had been given to me as a pet.

Time.......

6

The part of farming enjoyed most by a boy is the making of maple sugar. It is better than blackberrying and almost as good as fishing. One reason why a boy likes this work is that some one else does most of it. It is a sort of work in which he can appear to be very industrious and yet do but little.

Time.......

7

It was one of those wonderful evenings such as are found only in this magnificent region. The sun had sunk behind the mountains, but it was still light. The pretty twilight glow embraced a third of the sky, and against its brilliancy stood the dull white masses of the mountains in evident contrast.

Time.......

8

The crown and glory of a useful life is character. It is the noblest possession of man. It constitutes a rank in itself, an estate in the general good will, dignifying every station and exalting every position in society. It exercises a greater power than wealth, and is a valuable means of securing honor.

Time.......

9

He was six feet tall and his body was well proportioned. His complexion inclined to the florid; his eyes were blue and remarkably far apart. A profusion of hair covered the forehead. He was scrupulously neat in his appearance; and, although he habitually left his tent early, he was well dressed.

Time.......

10

Responding to the impulse of habit, Josephus spoke as of old. The others listened attentively but in grim and contemptuous silence. He spoke at length, continuously, persistently, and ingratiatingly. Finally exhausted through loss of strength he hesitated. As always happens in such exigencies, he was lost.

Time. . . . .

11

The attractions of the American prairies as well as of the alluvial deposits of Egypt have been overcome by the azure skies of Italy and the antiquities of Roman architecture. My delight in the antique and my fondness for architectural and archaeological studies verge on fanaticism.

Time. . . . .

12

The hypotheses concerning physical phenomena formulated by the early philosophers proved to be inconsistent and in general not universally applicable. Before relatively accurate principles could be established, physicists, mathematicians, and statisticians had to combine forces and work arduously.

Time. . . . .

SUPPLEMENTARY SILENT READING TESTS

As has been indicated, the preceding tests may not give sufficient data for a diagnosis. This part of the chapter gives additional tests which may be used as the occasion demands. A statement immediately before each test gives its purpose and the type of pupil to whom it may be given.

STANDARDIZED SILENT READING TEST

DEVISED BY DANIEL STARCH

The purpose of this test is to determine the child's rate of reading and his ability to comprehend short selections of varying difficulty as indicated by his ability to reproduce the selections read. It may be given to those pupils whose silent reading ability, in the opinion of the teacher, has not been adequately tested by the Monroe tests. The response here involves reproduction. This may place certain children at an advantage and others at a disadvantage.

DIRECTIONS FOR GIVING THE TEST

1. Follow the same general directions for putting the child at ease, and for the preliminary features of the test.

2. The same general directions for keeping time may be followed as in the oral test. Allow just 30 seconds. Have the child mark the word where he is reading when time is called.

3. Notice for vocalization as before.

4. Have the pupil attempt three selections. A third grade pupil may try selections one, three, and five. A fourth grade pupil should try selections two, four and six. This general plan may be followed for any pupil. Space is provided in the record blank for only one selection. This is the selection which has the same number as the school grade of the child.

5. Have the pupil fill in the blanks for age, grade, etc.

6. Score and record the results according to directions on pages 334 and 342.

SUGGESTIONS UPON INTERPRETATION OF RESULTS

The following questions may now be considered:

1. Did the pupil write much which is wrong? If so, it indicates that the apperceptive factor plays a large part in his reading. Try the Trabue Language Test.

2. Did the pupil write very little? If so, it indicates a language difficulty. Try the Direction Test.

3. See preceding tests for other suggestions.

4. Do the results of this test differ essentially from the results obtained by the Monroe Test? If so, it may indicate

that the pupil either did not understand the Monroe Test or that he is better at one type of reading than another.

DIRECTIONS TO THE PUPIL:

On the following pages are some selections which you are to read silently. After you have read a selection, turn over the page and write in your own words what you remember of the passage. You will be graded both on what you remember and on the rate at which you read. Your teacher will tell you which selection to read.

Name.......................*Grade*...........*Age*.........

Date............

1

Once there was a little girl who lived with her mother.

They were very poor.

Sometimes they had no supper.

Then they went to bed hungry.

One day the little girl went into the woods.

She wanted sticks for the fire.

She was so hungry and sad!

"Oh, I wish I had some sweet porridge!" she said.

"I wish I had a pot full for mother and me. We could eat it all up."

Just then she saw an old woman with a little black pot.

She said, "Little girl, why are you so sad?"

"I am hungry," said the little girl.

2

Betty lived in the South, long, long ago. She was only ten years old, but she liked to help her mother.

She had learned to do many things. She could knit and sew and spin; but best of all she liked to cook.

One day Betty was alone at home because her father and mother and brother had gone to town to see a wonderful sight.

The great George Washington was visiting the South. He was going from town to town, riding in a great white coach trimmed with shining gold. It had leather curtains, and soft cushions. Four milk-white horses drew it along the road.

Four horsemen rode ahead of the coach to clear the way and four others rode behind it. They were all dressed in white and gold.

3

Little Abe hurried home as fast as his feet could carry him. Perhaps if he had worn stockings and shoes like yours he could have run faster. But, instead, he wore deerskin leggins and clumsy moccasins of bear skin that his mother had made for him.

Such a funny little figure as he was, hurrying along across the rough fields! His suit was made of war homespun cloth. His cap was made of coon skin, and the tail of the coon hung behind him, like a furry tassel.

But if you could have looked into the honest, twinkling blue eyes of this little lad of long ago, you would have liked him at once.

In one hand little Abe held something very precious. It was only a book, but little Abe thought more of that book than he would have thought of gold or precious stones.

You cannot know just what that book meant to little Abe, unless you are very fond of reading. Think how it would be to see no books except two or three old ones that you had read over and over until you knew them by heart!

4

The red squirrel usually waked me in the dawn, running over the roof and up and down the sides of the house, as if sent out of the woods for this very purpose.

In the course of the winter I threw out half a bushel of ears of sweet corn onto the snow crust by my door, and was amused by watching the motions of the various animals which were baited by it. All day long the red squirrels came and went, and afforded me much entertainment by their maneuvers.

One would approach, at first, warily through the scrub-oaks, running over the snow crust by fits and starts like a leaf blown by the wind. Now he would go a few paces this way, with wonderful speed, making haste with his ' trotters," as if it were for a wager; and now as many paces that way, but never getting on more than half a rod at a time.

Then suddenly he would pause with a ludicrous expression and a somerset, as if all eyes in the universe were fixed on him. Then, before you could say Jack Robinson, he would be in the top of a young pitch-pine winding up his clock and talking to all the universe at the same time.

5

Once upon a time, there lived a very rich man, and a king besides, whose name was Midas; and he had a little daughter whom nobody but myself ever heard of, and whose name I either never knew, or have entirely forgotten. So, because I love odd names for little girls, I choose to call her Marygold.

This King Midas was fonder of gold than anything else in the world. He valued his royal crown chiefly because it was composed of that precious metal. If he loved anything better, or half so well, it was the one little maiden who played so merrily around her father's footstool. But the more Midas loved his daughter, the more did he desire and seek for wealth. He thought, foolish man! that the best thing he could possibly do for his dear child would be to give her the immensest pile of yellow, glistening coin, that had ever been heaped together since the world was made. Thus, he gave all his thoughts and all his time to this one purpose. If ever he happened to gaze for an instant at the gold-tinted clouds of sunset, he wished that they were real gold, and that they could be squeezed safely into his strong box. When little Marygold ran to meet him, with a bunch of buttercups and dandelions, he used to say, "Poh, poh, child! If these flowers were as golden as they look, they would be worth the plucking!"

And yet, in his earlier days, before he was so entirely possessed of this insane desire for riches, King Midas had shown a great taste for flowers.

6

In a secluded and mountainous part of Styria there was in old time a valley of the most surprising and luxuriant fertility. It was surrounded on all sides by steep and rocky mountains, rising into peaks which were always covered with snow, and from which a number of torrents descended in constant cataracts. One of these fell westward over the face of a crag so high that, when the sun had set to everything else, and all below was darkness, his beams still shone full upon this waterfall, so that it looked like a shower of gold. It was, therefore, called by the people of the neighborhood, the Golden River. It was strange that none of these streams fell into the valley itself. They all descended on the other side of the mountains, and wound away through broad plains and past populous cities. But the clouds were drawn so constantly to the snowy hills, and rested so softly in the circular hollow, that in time of drought and heat, when all the country round was burnt up, there was still rain in the little valley; and its crops were so heavy and its hay so high, and its apples so red, and its grapes so blue, and its wine so rich, and its honey so sweet, that it was a marvel to everyone who beheld it, and was commonly called the Treasure Valley.

The whole of this little valley belonged to three brothers called Schwartz, Hans, and Glück. Schwartz and Hans, the two elder brothers, were very ugly men, with overhanging eyebrows and small dull eyes.

7

Captain John Hull was the mint-master of Massachusetts, and coined all the money that was made there. This was a new line of business, for in the earlier days of the colony the current coinage consisted of gold and silver money of England, Portugal, and Spain. These coins being scarce, the people were often forced to barter their commodities instead of selling them.

For instance, if a man wanted to buy a coat, he perhaps exchanged a bear skin for it. If he wished for a barrel of molasses, he might purchase it with a pile of pine boards. Musket-bullets were used instead of farthings. The Indians had a sort of money called wampum, which was made of clam-shells, and this strange sort of specie was likewise taken in payment of debts by the English settlers. Bank-bills had never been heard of. There was not money enough of any kind, in many parts of the country, to pay the salaries of the ministers, so that they sometimes had to take quintals of fish, bushels of corn, or cords of wood instead of silver or gold.

As the people grew more numerous and their trade one with another increased, the want of current money was still more sensibly felt. To supply the demand the general court passed a law for establishing a coinage of shillings, sixpences, and threepences. Captain John Hull was appointed to manufacture this money, and was to have about one shilling out of every twenty to pay him for the trouble of making them.

8

The years went on, and Ernest ceased to be a boy. He had grown to be a young man now. He attracted little notice from the other inhabitants of the valley; for they saw nothing remarkable in his way of life, save that, when the labor of the day was over he still loved to go apart and gaze and meditate upon the Great Stone Face. According to their idea of the matter it was a folly, indeed, but pardonable, inasmuch as Ernest was industrious, kind, and neighborly, and neglected no duty for the sake of indulging this idle habit. They knew not that the Great Stone Face had become a teacher to him, and that the sentiment which was expressed in it would enlarge the young man's heart, and fill it with wider and deeper sympathies than other hearts. They knew not that thence would come a better wisdom than could be learned from books, and a better life than could be molded on the defaced example of other human lives. Neither did Ernest know that the thoughts and affections which came to him so naturally, in the fields and at the fireside, and wherever he communed with himself, were of a higher tone than those which all men shared with him.

By this time poor Mr. Gathergold was dead and buried; and the oddest part of the matter was, that his wealth, which was the body and spirit of his existence, had disappeared before his death, leaving nothing of him but a living skeleton, covered over with a wrinkled, yellow skin. Since the melting away of his gold, it had been very generally conceded that there was no such striking resemblance, after all, betwixt the ignoble features of the ruined merchant and that majestic face upon the mountainside.

SPEED TEST

This test is to determine the effect which is produced when a maximum effort is put into reading. It will be of value for those pupils who are slow and for those who are thought to work with little effort.

DIRECTIONS FOR GIVING THE TEST

1. Follow the same general directions for putting the child at ease, and for other preliminary features of the test.
2. The same general directions for keeping time may be followed as in the oral test. Make a record of the time, first upon note paper and later transfer it to the place provided upon the test sheet in the hands of the child. It may also be of value to keep time for the period which is used in writing.
3. Notice for vocalization as before.
4. Only three selections are provided. Use your own judgment as to the number which the child can read with any degree of success.
5. If this test is used, it will be necessary to give the Starch Test also, so that a more direct comparison can be made than in the case of the Monroe Test.
6. See directions for scoring and recording results on pages 334 and 342.

SUGGESTIONS FOR INTERPRETATION

1. Do the results indicate an increase in rate and a decrease in comprehension? If so, the pupil was probably reading to his limit in the other tests.
2. Do the results indicate an increase in both rate and comprehension? If so, the pupil evidently did not work up to his limit in the preceding tests.

DIRECTIONS TO THE PUPIL:

On the following pages are some selections which you are to read silently. They are to be read *just as rapidly as you can* *read.* You will be expected to write the story of the selection but remember that the emphasis is on how *rapidly you can read.* After you have read a selection turn over the page and write in your own words what you remember of the passage.

SPEED I

Name........................*Grade*...........*Age*.........

Date...........

A man and a lion once traveled together. Each one boasted of his own strength, as if he were greater than the other. As they were disputing, they passed a stone statue, which stood near the road. It represented a lion killed by a man.

"See," said the man, "how strong we men are! Even the king of beasts must yield to us."

"That sounds very well," replied the lion. "Was it a lion who made the statue, or a man? Perhaps we would have told a different story."

There are two sides to everything.

Reading time........... *Writing time*...........

SPEED II

I believe we can nowhere find a better type of a perfectly free creature than in the common house fly. Nor free only, but brave; and irreverent to a degree which I think no human republican could by any philosophy exalt himself to. There is no courtesy in him; he does not care whether it is king or clown whom he teases; and in every step of his swift mechanical march, and in every pause of his resolute observation, there is one and the same expression of perfect egotism, perfect independence and self-confidence, and conviction of the world's having been made for flies.

Reading time........... *Writing time*...........

SPEED III

Nitetis, a beautiful young princess, the daughter of Amasis, king of Egypt, had, for political reasons, been betrothed to Cambyses, king of the Medes and Persians, and most powerful monarch of his time. After bidding a final adieu to her parents and friends and all that her heart held dear, she had started with a brilliant retinue of followers on the long journey to Babylon, the home of her intended husband. She was accompanied by her father's friend Croesus, the old and wealthy king of Lydia, who acted in the capacity both of tutor and guardian; and everything was done that power or skill could devise to make the journey by sea and land delightful and easy.

Reading time........... *Writing time*...........

TEST IN OUTLINING

The purpose of this test is to determine the child's ability to comprehend a passage as indicated by the outlining of it. The test requires little language ability, but there must be a rather careful evaluation of the various thoughts in the passage. It will be of value in those cases in which the Monroe and Starch Tests seem to be inadequate or where the examiner thinks that language may be a hindrance in the responses of the child.

DIRECTIONS FOR GIVING THE TEST

1. Follow the same general directions for putting the child at ease and for other preliminary features of the test.
2. The same general directions for keeping time may be followed as in the oral test. Make a record of the time first upon note paper and later transfer it to the place provided upon the test sheet. It may also be of value to keep time for the period which is used in writing.
3. Notice for vocalization as before.

4. Only three selections are provided. Use selection one for grades four and five, selection two for grades six and seven, and selection three for grade eight.

5. Score and record the results according to the directions on pages 334 and 342.

SUGGESTIONS UPON INTERPRETATION

1. Do the results show a lack of ability to evaluate the different parts of the thought? If so, try the Trabue Language Test.

2. Do the results correspond to those of either the Monroe or Starch tests? If much better, it may mean the presence of a language difficulty.

DIRECTIONS TO THE PUPIL:

You are to read the next selection *silently*. Read each one *once*, but read *carefully*. You will be expected to write out what you consider to be the *main points* in each selection.

Name........................*Grade*.........*Age*........

Date...........

Outline I

The blood carries food for the body. After leather, yarn, and cloth are manufactured, they are not stored away and locked up in factories, but are sent out over the country by railroads, canals, and rivers to cities, towns, and villages, so that the people who need them can find and use them.

In the same way, after our food is manufactured into blood, it does not remain in the factory, but is sent out to all parts of the body, so that it can be used in building it up and repairing it.

Instead of railroads, canals, and rivers, we have running through our bodies a system of little tubes; and instead of railroad trains and canal boats, we have the warm, red blood flowing through these tubes, loaded with material the body needs to build it up. In your chest is the heart, a muscular pump which works without ceasing day and night as long as you live and forces the blood through all of the blood tubes, even to the very tips of your fingers and toes.

Reading time. . . . . *Writing time*. . . . .

Outline II

We started off about noon; a goodly band of some eight or nine striplings, with two or three hammers, and a few pence among us, and no need to be home before dusk. An October sun shone merrily out upon us; the fields, bared of their leaves, had begun to be again laid under the plow, and long lines of rich brown loam alternated with bands of yellow stubble, up and down which toiled many a team of steaming horses. The neighboring woods, gorgeous in their tints of green, gold, and russet, sent forth clouds of rooks, whose noisy jangle, borne onward by the breeze, and mingling with the drone of the bee and the carol of the lark, grew mellow in the distance, as the cadence of a far-off hymn. We were too young to analyze the landscape, but not too young to find in every feature of it the intensest enjoyment. Moreover, our path lay through a district rich in historic associations.

Reading time. . . . . *Writing time*. . . . .

Outline III

The simplest attempts to form monopolies consist of agreements between a number of producers to limit the product, to maintain fixed prices, or to appoint common selling-agents. These agreements are seldom lived up to, and mutual suspicion among the members generally breaks them up. Yet a "friendly agreement" between four large beef packers in Chicago has sufficed to build up a practical monopoly of the cattle and meat business of the United States. In other cases, where the number of parties to the agreement has been small, this form of combination has created virtual monopolies. A second and more formal organization is the "pool." This is established by a formal agreement to maintain prices, in which the parties agree to divide the territory, to divide the business, or to divide the earnings. Pools have been common in the railroad business but have existed elsewhere, as in cases where nominally competing gas companies agree to serve separate districts in a city, and not to encroach upon each other's territory. Pools have often enough been broken up by the mutual distrust of the members; for, if one party to the pooling agreement breaks it while the others keep their promises, he may make large profits.

Reading time. . . . . *Writing time*. . . . .

DIRECTION TEST

DEVISED BY WOODWORTH AND WELLS

This test is to determine the child's ability to comprehend simple directions. It eliminates almost entirely the language element in the response and is of very great value where language seems to make the response difficult for the child. Success in this test when there has been a failure in other tests may indicate that the child lacks ability to express himself in language.

DIRECTIONS FOR GIVING THE TEST

1. Follow the same general directions for putting the child at ease, place for testing, etc.
2. Notice for vocalization as before.
3. Keep a record of the time required for the writing.
4. Score and record the results according to directions on pages 335 and 343.

DIRECTIONS TO THE PUPIL:

On the next sheet you are told to do a number of very simple things. Do these *just as rapidly as you can.* The emphasis is upon *speed.*

Name. . . . . *Grade*. . . . . *Age*. . . . .

Date. . . . .

Cross out the *g* in *tiger*

Write 2 between the two dots: • • ——

How many feet make a yard?

Write + over the longest word: It rained yesterday.

Put a dot below this line: ————————

Write the sum of these numbers: $\begin{array}{c}3\\4\end{array}$

Make a boy's name by adding one letter to Joh

Make a cross in the circle: △ ○ □

What comes next after D in the alphabet?

Write 7 in the largest square: □ ☐ □

Cross out the blackest letter in TE**X**AS.

Write *g* on the egg-shaped figure:

Make two dots between these lines:

Put the sign = where it belongs: 3+2 5.

Write here..... the middle letter of *get.*

Put a nose on this face:

Add a cross and make these rows equal:
× × ×
× × × ×

Put a dot in the circle, below the center: ⊙

Draw a line around the three dots: • • • • •

Cross out the last word in this sentence.

NEWSPAPER TEST

This is a test to determine the child's ability in skimming. It is of interest as a speed test, or it may be of value in those cases where it is thought that the pupil lacks ability to express himself in language.

DIRECTIONS FOR GIVING THE TEST

1. Select an article from some newspaper of six or eight pages. Insert the name of the article in the blank space left in the directions to the pupil.
2. Note the time required to find the article. Record this in the proper place in the summary sheet.
3. In order to have a basis for comparison give the same test to two or three bright children in the same grade as that of the one whom you are studying.
4. Score and record results according to directions on pages 336 and 346.

DIRECTIONS TO THE PUPIL:

For your next work you will be given a newspaper. Some place in this paper there is a short article entitled ———. You are expected to find this article as *quickly* as possible.

STANDARDIZED LANGUAGE TESTS

DEVISED BY M. R. TRABUE

This test is given for the purpose of determining the child's ability to deal with language relations. It is of interest in those cases where it is thought that the child has difficulty in expressing himself by means of written language or where it is desired to determine the relation between the ability required in this test and the ability to comprehend.

DIRECTIONS FOR GIVING THE TEST

1. Allow just seven minutes.
2. Watch the child's method of work.

3. Score and record results according to directions on pages 336 and 343.

DIRECTIONS TO THE PUPIL:

On the page which follows there is a reading selection with a part of the words left out. You are to put in words which will make the selection have good sense. An example is given here. The sentence The boy can —— has a word left out where the line is. If the word *run* is put in there, the sentence makes good sense. You are to do the same thing in the selection which follows. Remember *one* word for each line. You will be allowed seven minutes.

Name............................*Grade*.........*Age*.........

Date...........

1. We like good boys —— girls.
6. The —— is barking at the cat.
3. The stars and the —— will shine to-night.
22. Time —— often more valuable —— money.
23. The poor baby —— as if it were —— sick.
31. She —— if she will.
35. Brothers and sisters —— always —— to help —— other and should —— quarrel.
38. —— weather usually —— a good effect —— one's spirits.
48. It is very annoying to —— —— tooth-ache, —— often comes at the most —— time imaginable.
54. To —— friends is always —— the —— it takes.

STANDARDIZED TESTS FOR VISUAL VOCABULARY

DEVISED BY E. L. THORNDIKE

This test is given in order to determine the pupil's ability in the recognition of isolated words. It is of interest in those cases where preceding results indicate a lack of vocabulary.

DIRECTIONS FOR GIVING THE TEST

1. Allow the pupil all the time that he may desire. This test may well be taken during the regular school work.

2. Watch the pupil's method of work.

3. Score and record results according to directions on pages 340 and 343.

Name........................*Grade*........*Age*.........

Date...............................

DIRECTIONS TO THE PUPIL:

Write the letter *F* under every word that means a *flower*.

Write the letter *A* under every word that means an *animal*.

Write the letter *N* under every word that means a *boy's name*.

Write the letter *G* under every word that means a *game*.

Write the letter *B* under every word that means a *book*.

Write the letter *T* under every word like *now* or *then* that means something to do with *time*.

Write the word *GOOD* under every word that means something *good to be or do*.

Write the word *BAD* under every word that means something *bad to be or do*.

4. Camel, samuel, kind, lily, cruel
5. cowardly, dominoes, kangaroo, pansy, tennis
6. during, generous, later, modest, rhinoceros
7. claude, courteous, isaiah, merciful, reasonable
8. chrysanthemum, considerate, lynx, prevaricate, reuben
9. ezra, ichabod, ledger, parchesi, preceding
10. crocus, dahlia, jonquil, opossum, poltroon
10. begonia, equitable, pretentious, renegade, reprobate
11. armadillo, iguana, philanthropic

CHAPTER XVII

PERCEPTION TESTS

This chapter presents certain tests which relate to the span of perception. They are of interest in those cases where there is a slow rate of reading or in those cases where the rate of reading is too rapid for efficiency.

SHORT-EXPOSURE TESTS

The results for this test may be procured by means of a simple form of tachistiscope. The working drawings of one form of this apparatus are shown on page 309. This form of the apparatus may be made in any manual training shop or by a local carpenter. The exposure is made by the falling of plate A. This has in it an opening the same size as that of B. The material to be exposed is placed in the holder immediately back of the opening B, and as the plate A drops, the material can be seen by the subject during the time that the opening in A passes the opening B.

The material to be exposed can be prepared upon cards (3 x 5) by means of a typewriter. Only one sentence should be placed upon each card.

DIRECTIONS FOR GIVING THE TESTS

In carrying out the experiment, the child should be comfortably seated, the lighting should be good, and a few preliminary exposures should be made in order to accustom the subject to the conditions of the experiment.

When everything is ready, say "Ready." The pupil then focuses his eyes upon the plate at the point where the material will appear. In about the time which it takes to count "one," "two" pull the trigger which allows the plate to fall. The child will then write down what has been seen, or, better, an assistant may record the words reported by the subject.

MATERIAL FOR PERCEPTION TESTS

1. Pick flowers.
2. The wind sings.
3. I will help you find it.
4. There comes a cloud.
5. The trees like the singing wind.
6. The ark is ready.
7. They will keep step as they march.
8. One of my chicks is lost.
9. I love the little bird.
10. Swim and play.
11. Here come two birds.
12. One day the two woodmen sat down.
13. Come again.
14. They bow to the wind.
15. Bake her cake.
16. Betty loves the gray kitten.
17. They sang.
18. Two little birds flew into the tree.

See directions on page 340 for scoring and recording results.

SUGGESTIONS UPON INTERPRETATION

1. Is the rate of silent reading slow and the span of perception small? If so, the difficulty is probably a fundamental one. Try the voice-eye separation test.

2. Is the rate of silent reading slow and the span of perception average or above? If so, there are several possibilities. The child may be overcareful or he may not be able to make interpretations of the language units in rapid succession, as is required in the reading process, or he may not put sufficient effort into the work.

3. Is the rate of silent reading fast, and the span of perception small? If so, the child may be a subjective reader, or he may read in a careless and indifferent manner.

4. Does the child get many of the words wrong? If so, he probably uses the synthetic approach to language in too great a degree. Analysis needs to be emphasized.

5. Does the child fail to get many of the sentences? If so, he probably uses the analytic approach to language in too great a degree.

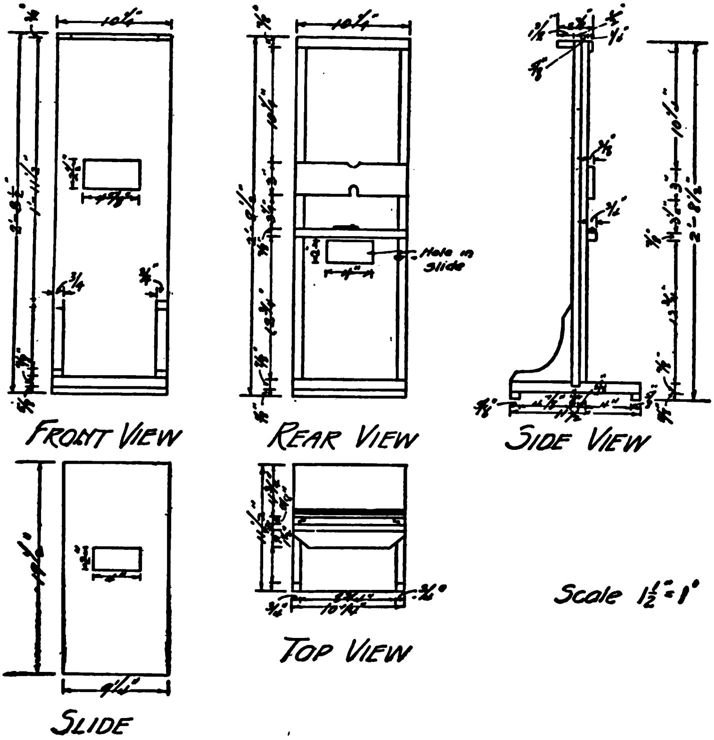


FIG. 20

Showing Working Drawings for One Form of Short-exposure Apparatus

THE VOICE-EYE SEPARATION TEST

This test gives data concerning the span of perception in oral reading. It is of interest in those cases where the rate of reading is slow. The results are obtained by placing a card over the reading matter at certain predetermined points. The subject should proceed with the reading as far as possible after the card is in place. The following list gives the predetermined words for each of the eight selections which follow. These words come at the beginning of a line in each case.

Selection 1.	up
Selection 2.	played, in line 6
Selection 3.	work
Selection 4.	had, in seventh line
Selection 5.	rest
Selection 6.	fell
Selection 7.	becomes, at beginning of seventh line
Selection 8.	exceeded

DIRECTIONS FOR GIVING TEST

1. Have the child seated comfortably. Let him read the first selection and just as he begins to speak the word "up," place the card over the selection. The pupil should repeat as many words as possible beyond the word "up." It is an excellent practice to have an assistant record the words repeated by the pupil. If no assistant is available, the child may record his own results, or the recording may be done by the examiner.
2. Allow the child to read as many of the selections as he is able to.
3. See directions on page 340 for scoring and recording results.

SUGGESTIONS UPON INTERPRETATION

1. If the rate of reading is slow and the results of this test indicate a small span of perception, there are again several *possibilities*. There may be a lack of knowledge of words or of

language relations. If this is thought to be true, try the vocabulary test and the Trabue Language Test. Results as indicated above may also give evidence that the span is short as a result of training or as a result of hereditary factors.

2. If the rate of reading is slow and the results of this test indicate a long span of perception, there may be inability to use in the rapid process of reading the entire span of perception.

3. If a considerable amount of incorrect material is reported, the apperceptive processes may be too active or it may be that the child uses the synthetic approach to language.

4. Comparisons between the results of this test and those of the preceding test will be of interest.

MATERIAL FOR VOICE-EYE SEPARATION

TEST

1

I'll make a big scarecrow and stand it up in the cherry tree. That will do it. I'll have an old coat on that scarecrow and an old hat on its head. They will make it look like a man, and that will scare the robins.

2

Biddy Black's children always did as they were told, and they never forgot. No, Biddy Black's children never forgot. What fun the soft, fat, fluffy chickens had! They ran and played and ran and played all day. They ate the bugs and seeds that Biddy found. Oh, they played and ate bugs and seeds all day!

3

Whenever the cores gave out, back to the city went Appleseed John to work for more. As he went from house to house, singing and working, some called him lazy, while others said he was only crazy. But on and on he went, planting the appleseeds far and wide over hillside and prairie. Old Appleseed John knew that in after years great trees

4

Longfellow had more friends among children than he could count. They used to write to him from all over the land and send him little gifts. No matter how busy he was, the poet had time to send some little token in return. Longfellow had five children of his own whom he loved most dearly. He tells about them in this letter to his little friend.

5

But great allowance should be given to a king who lived wholly secluded from the rest of the world, and must, therefore, be altogether unacquainted with the manners and customs that must prevail in other nations; the want of which knowledge will ever produce many prejudices, and a certain narrowness of thinking, from which we, and the politer countries of Europe,

6

A portion of the Grecian host broke up camp and set sail as if they were homeward bound; but, once out of sight, they anchored their ships behind a neighboring island. The rest of the army then fell to work upon the great image of a horse. They built it of wood, fitted and carved, and with a door so cunningly concealed that none might notice it.

7

Thus, gentlemen, we see that a man's country is not an area of land, of mountains, rivers, and woods, but it is a principle; and patriotism is loyalty to that principle. In poetic minds and in popular enthusiasm this feeling becomes closely associated with the soil and the symbols of the country. But the secret sanctification of the soil and

8

Large piles of brush lay scattered about the clearing, and a wary and aged squaw was occupied in firing as many as might serve to light the coming exhibition. As the flame arose, its power exceeded that of the parting day, and assisted to render objects at the same time more distinct and more hideous. The whole scene formed a striking picture.

CHAPTER XVIII

TESTS AND OBSERVATIONS IN THE MOTOR PROCESSES

It is the purpose of this chapter to present various types of tests and observations in the motor processes involved in reading. Certain of these tests and observations give data as to the rate of reading; others show the adjustment of the child to the reading process; and still others may be used in various ways. The same general plan for presenting the material will be followed as in the preceding chapters. Each of the tests should be studied carefully, and if its general bearing is not understood, the reader should refer to the chapter in Part I where the test, along with its results, is discussed.

TESTS FOR RATE OF VOCALIZATION

THE PRONUNCIATION TEST

This test is given for the purpose of determining the rate at which a child can pronounce a list of familiar words. It involves both a limited amount of interpretation and the rate at which the vocal muscles react. It is of value where the rate of reading is slow.

DIRECTIONS FOR GIVING THE TEST

1. Have the child pronounce as rapidly as possible the following lists of words. Note that the same words are used three times, but in a different order.
2. Time the test by the "Ready — Begin" method. Take the time for each list.
3. Record the results in the form shown on page 344.
4. If the child hesitates on a word, pronounce it for him and let him proceed.
5. Note the errors in pronunciation.

SUGGESTIONS UPON INTERPRETATION

1. If the rate on this test is slow and the rate of reading is slow, there may be a lack of knowledge of words. Try the vocabulary test.

2. If the rate upon this test is rapid and the rate of reading is slow, the slowness in reading is evidently caused by other factors than a knowledge of isolated words.

DIRECTIONS TO THE PUPIL:

Pronounce these words just as *rapidly* as you can;

boy
dog
home
mouse
milk
king
found
woods
stroll
might
nest
maple
reason
region
crown
general
body
early
spoke
delight
before
frost

king
nest
general
before
strut
wagon
milk
stroll
region
spoke
spear
snow
boy
night
dog
reason
frost
house
found
maple
home
early

wagon
house
snow
spirit
wind
strut
feast
spear
frost
before
delight
spoke
early
body
general
crown
region
reason
maple
nest
night
stroll

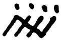
spear
feast
strut
wind
spirit
snow
house
wagon
wind
delight
mouse
crown
feast
body
woods
spirit
woods
found
king
milk
mouse
home
dog
boy

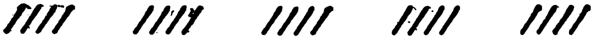
THE COUNTING TEST

This test is given for the purpose of determining the rate at which the vocal muscles function. It is of interest in those cases where the oral rate is slow.

Directions for Giving Test

1. The test consists in having the child count repeatedly as fast as possible from one to ten for fifteen seconds.

2. A record of the counting may be made by means of the marks shown below, as follows: When the child says "ten" the first time place a dot over the first vertical mark; continue this until the child says "ten" for the fifth time, when a diagonal line may be drawn across the first four vertical lines. The record for the counting of fifty would appear thus:  This may be continued until the time is up. For convenience draw a series of lines as shown below on note paper.



3. Record the results in their proper place on page 344.

Suggestions on Interpretation

1. If the rate in this test is slow and the rate of oral reading is slow, the cause of the slow reading is due in a measure to slow *muscular* reactions.

2. If the results of this test indicate rapid muscular reaction and the rate of oral reading is slow, then the slowness in the reading process is caused by other factors than slow muscular reaction.

DIRECTIONS TO THE PUPIL:

The next work is very simple and very easy. You are to count as *rapidly* as you can for 30 seconds as follows: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10; 1, 2, 3, 4, 5, 6, 7, 8, 9, 10; etc.

OBSERVATIONS ON VOCALIZATION IN SILENT READING

This type of observation gives data which reveal in some cases the cause of slow silent reading. It may also point out children for whom the motor phases of their mental operations are of decided importance.

DIRECTIONS FOR MAKING THE OBSERVATIONS

1. The observations upon this point can be made during the silent reading tests. Look for the following points:

a. Is the vocalization such as to be called a whisper?
b. Does it involve only slight movements of the lips?
c. Does it involve only slight movements of the larynx?
d. Is it entirely imperceptible?
e. A general estimate may be given in the following terms: none, little, much.

2. Record this general estimate on the summary sheet, page 346.

SUGGESTIONS UPON INTERPRETATION

1. If the rate of silent reading is slow and the amount of vocalization is large, the slow reading is probably caused in part by the presence of the vocalization. In some cases there will be a considerable amount of vocalization, and yet the rate of reading will be rapid. Other causes must then be sought for the slow rate. Try the perception tests.

2. If there is much vocalization present in the reading and the child is motor in the other phases of his work, it probably means that the vocalization is somewhat essential to the interpretative processes.

OBSERVATIONS UPON EXTRANEOUS MOVEMENTS

This type of observation is made in order to determine the child's adjustment to the entire reading situation.

DIRECTIONS FOR MAKING OBSERVATIONS

1. Watch for movements of the body which are entirely foreign to the reading activity. Such movements as jerking the head backward or forward would be classed as extraneous movements. Score this phase of reading as

none, few, many.

2. Insert the estimate on the summary sheet, page 346.

SUGGESTIONS UPON INTERPRETATION

1. The presence of such movements may mean a habit carried over from the early period of the child's reading.
2. They may mean that the child has not progressed far enough in the formation of the reading habit so that the diffusion of nervous energy which usually accompanies early efforts at reading has disappeared.

OBSERVATIONS UPON VOCAL MOVEMENTS

This type of observation will indicate possible causes for difficulties in pronunciation in the analysis required by phonics.

DIRECTIONS FOR MAKING THE OBSERVATIONS

1. Does the pronunciation of the child have a nasal quality?
2. Are sounds omitted from certain words?
3. Are any sounds imperfectly made?

4. Are there any physical imperfections which would cause the points noted above?

5. On the basis of these observations determine a general estimate, as follows:

poor, good, very good.

6. Record this estimate in its proper place on the summary sheet, page 346.

OBSERVATIONS OF BREATHING IN RELATION TO ORAL READING

This type of observation is made in order to determine the child's adjustment to the requirements of oral reading. Poor coördinations of this type may point to causes for poor oral reading.

DIRECTIONS FOR MAKING THE OBSERVATIONS

1. The teacher will be able to make the observations upon this element of oral reading during the regular reading. Under other circumstances, have the child read any selection which is not familiar and not too difficult. Look for the following points:

a. Does breathing during reading seem to be a problem for the child?

b. Is the greater movement in the upper chest or the abdomen?

c. Is the breathing deep or is it taken in gasps?

d. Is the breathing regular?

e. Is there any correspondence between the sense pauses and breathing pauses?

2. On the basis of the above observations determine a general estimate as follows·

poor, good, very good.

3. Record this general estimate in its proper place on the summary sheet, page 346.

OBSERVATIONS OF EYE-MOVEMENTS

This type of observation is made for the purpose of obtaining data concerning the forward and regressive movements of the eyes. Such observations will be of interest in nearly every case where a difficulty exists in learning to read, and will reveal in most cases more about the reading activity than any other single test or method of observation listed here.

DIRECTIONS FOR MAKING OBSERVATIONS

1. The observations are made by means of a mirror. See page 176. For this purpose select a mirror 5 x 7 inches without a frame. Place the mirror on the left page and have the child read from the right page or vice-versa. Sit immediately in front of the child and the eye movements may be easily observed.

2. Three types of movements will be observed. (*a*) Long sweeps from the right to the left. These sweeps are the movements of the eye from the end of one line to the beginning of another. (*b*) Short jerks from the left to the right. These are the forward movements of the eye as it proceeds across the page. (*c*) Short jerks from right to left. These are backward or regressive movements.

3. Passages are provided for both oral and silent reading. Use your own judgment as to whether records should be made for both types of reading. The number accompanying each of these selections corresponds to the grade for which the passage was selected. Have each child read the selection for his grade, the one immediately below, and the one immediately above. Accordingly, a pupil of the sixth grade will read passages 5, 6, and 7.

4. Record the number of short forward movements and the short backward movements on the sheet shown on page 000. Record these first on note paper and then transfer them to the *blank*.

5. Some practice will be required before the type of work can be done with accuracy.

SUGGESTIONS ON INTERPRETATION

After the results have been compiled, the following questions may be considered:

1. Are there periods of confusion? If so, the child shows a fundamental lack in the knowledge of words. Try the vocabulary test.

2. Is the number of pauses about the same in oral and silent reading? If so, the child may not be able to distinguish between the methods of interpretation required by the two types of reading. In cases of this kind there may also be a short span of perception.

3. Is the number of regressive movements large? If so, the child may be overcareful or may lack in the fundamentals of the reading habit such as the knowledge of words and language relations. Try the vocabulary test or the Trabue Language Test.

4. Is the number of pauses large both in oral and silent reading? If so, the span of perception may be at fault. Try the short-exposure experiment.

5. Are the pauses very long? If so, there may be a fundamental lack in the knowledge of words. Try the vocabulary test. In cases of this kind the assimilative process may be slow.

6. Are the pauses very short? If so, this may be the cause of inaccurate reading. In cases of this type the apperceptive processes are usually too active.

7. Record results on page 345.

SELECTIONS TO BE USED IN THE OBSERVATIONS OF EYE-MOVEMENTS

SILENT READING

I

The farmer is sowing the wheat.
Shine, sun, shine brightly!
Help the farmer's wheat to grow.
Come, wind, and bring the rain!
Fall, rain, fall softly!
Help the farmer's wheat to grow.
Many days of sun and rain
  will bring the farmer golden grain.

2

Not far away, on a little hill, grew a spruce tree. The little bird hopped and rested, and fluttered and rested, and hopped again, till he came to the spruce tree. He was just about to sing to the spruce, when the tree said, —

"You poor little bird, what is the trouble? Why are you here?"

"I have broken my wing," answered the little bird. "I have been asking the trees to help me. But no one will shelter me."

3

Now, as the ball turns round, a little, and a little more, what is it that comes out of the dark and gleams in the light of the sun? It stretches wide as the ocean, and sparkles too;

in some places, smooth as a pond; in others, rolling as ocean waves. But it is not water that sparkles so. It is dry sand and rock we see. It is a desert, where streams are few, and few plants grow.

4

The moon had disappeared, and snow was falling rapidly, and the sound of distant chimes reminded Davy that it must be past midnight, and that Christmas Day had come. Solomon's eyes were shining in the darkness like a pair of coach lamps; and, as Davy sat looking at them, a ruddy light began to glow between them, and presently the figure of the Goblin appeared, dressed in scarlet, as when he had first come. The reddish light was shining through his stomach again, as though the coals had been fanned into life once more; and, as Davy gazed at him, it grew brighter and stronger and finally burst

5

There was another bird in the room, however, who knew what grasshoppers were good for. He was an orchard oriole; and, after looking on awhile, he came down and carried off the hopper to eat. The jay did not like to lose his plaything; he ran after the thief, and stood on the floor giving low cries and looking on while the oriole on a chair was eating the dead grasshopper. When the oriole happened to drop it, Jakie — who had got a new idea what to do with grasshoppers — snatched it up and carried it under a chair and finished it.

6

This uncounted multitude before me, and around me, proves the feeling which the occasion has excited. These thousands of human faces, glowing with sympathy and joy, and, from the impulses of a common gratitude, turned reverently to heaven, in this spacious temple of the firmament, proclaim that the day, the place, and the purpose of our assembling have made a deep impression on our hearts. If, indeed, there be anything in local association fit to affect the mind of man, we need not strive to repress the emotions which agitate us here. We are among the sepulchres of our fathers.

7

I snatched a cutlass from the pile, and someone, at the same time snatching another, gave me a cut across the knuckles which I hardly felt. I dashed out of the door into the clear sunlight. Someone was close behind, I knew not whom. Right in front, the doctor was pursuing his assailant down the hill, and, just as my eyes fell upon him, beat down his guard, and sent him sprawling on his back, with a great slash across the face.

8

On the lower step of this throne the champion was made to kneel down. Indeed his whole action, since the fight had ended, seemed rather to have been upon the impulse of those around him than from his own free will; and it was observed that he tottered as they guided him a second time across the lists. Rowena, descending from her station with a graceful and dignified step, was about to place the chaplet which she held in her hand upon the helmet of the champion, when the marshals exclaimed with one voice, "It must not be thus — his head must be bare." The knight muttered faintly a few words, which were lost in the hollow of his helmet, but their purport seemed to be a desire that his casque might not be removed.

SELECTIONS TO BE USED IN THE OBSERVATIONS OF EYE-MOVEMENTS

ORAL READING

1

O birdie in the apple tree.
Dear birdie, sing a song to me!
You have a nest and four eggs too.
Up where the wind is singing, "Oo-oo!"
You sing songs to the mother bird
The sweetest songs I ever heard.
O birdie in the apple tree.
Dear birdie, sing a song to me!

2

"Let us be good to the trees that took care of the little bird," said the Frost King. "They keep their leaves to shelter him. They are to be ever green — green not in summer only, but in winter too."

So the Frost King and North Wind were good to the spruce, the pine, and the juniper. These trees kept their leaves green all the winter, and they have kept their leaves green through every winter ever since.

3

In the morning he found two pairs of shoes ready made. He sold the two pairs and bought leather enough for four pairs. At night he left the leather cut out on the bench, as before; and in the morning there lay four pairs of shoes.

Every night, for a long time, the shoemaker cut out leather for four pairs of shoes; and every morning he found four pairs of shoes ready for him to sell.

4

This was so unexpected, and seemed so serious a matter, that Davy was much distressed, wondering what had become of his dear grandmother, and Mrs. Frump, the cook, and Mary Farine, the housemaid, and Solomon, the cat. However, before he had time to make any inquiries of the Goblin, his grandmother came dropping down through the air in her rocking-chair. She was quietly knitting, and her chair was gently rocking as she went by. Next came Mrs. Frump, with her apron quite full of kettles and pots, and then Mary Farine sitting on a step-ladder with the coal-scuttle in her lap. Solomon was nowhere to be seen.

5

Many things which Jakie did were very funny. For instance, he made it his business to clear up the room. When he had more food than he could eat at the moment, he did not leave it around, but put it away carefully, — not in the garbage pail, for that was not in the room, but in some safe nook where it did not offend the eye. Sometimes it was behind the tray in his cage, or among the books on the shelf. The places he liked best were about me, — in the fold of a ruffle or the loop of a bow on my dress, and sometimes in the side of my slipper. The very choicest place of all was in my loosely bound hair. That of course I could not allow, and

6

While they stood talking two immense serpents rose out of the sea and made towards the camp. Some of the people took flight, others were transfixed with terror; but all, near and far, watched this new omen. Rearing their crests, the serpents crossed the shore, swift, shining, terrible as a risen flood that descends upon a helpless town. Straight through the crowd they swept, and seized the priest Laocoön where he stood, with his two sons, and wrapped them all round and round in fearful coils. There was no chance of escape. Father and sons perished together; and when the monsters had devoured the three men, into the sea they slipped again, leaving no trace of the horror.

7

When I had first sallied from the door, the other mutineers had already been swarming up the palisade to make an end of us. One man, in a red night-cap, with his cutlass in his mouth, had even got upon the top and thrown a leg across. Well, so short had been the interval, that when I found my feet again all was in the same posture, the fellow with the red night-cap still half way over, another still just showing his head above the top of the stockade. And yet, in this breath of time, the fight was over, and the victory was ours.

8

To the surprise of all present, however, the knight thus preferred was nowhere to be found. He had left the lists immediately when the conflict ceased, and had been observed by some spectators to move down one of the forest glades with the same slow pace and listless and indifferent manner which had procured him the epithet of the Black Sluggard. After he had been summoned twice by sound of trumpet and proclamation of the heralds, it became necessary to name another to receive the honors which had been assigned to him. Prince John had now no farther excuse for resisting the claim of the Disinherited Knight, whom, therefore, he named the champion of the day.

CHAPTER XIX

DIRECTIONS FOR SCORING

This chapter is devoted to the directions which are necessary for scoring the various tests which have been given in the three chapters which immediately precede this. The instructions of the authors of the tests have been followed in every case as closely as possible. Some points not taken into account by the authors are considered here because of the requirements of diagnosis.

ORAL AND SILENT READING TESTS

DIRECTIONS FOR SCORING MONROE'S SILENT READING TEST

BY W. S. MONROE

1. Every paper is given two scores: a *rate score* and a *comprehension score.* The *rate score* has been so chosen that it represents the number of words read per minute when reading carefully, as in this test. The *comprehension score* represents a measure of the pupil's ability to understand or comprehend what he reads.

2. To find the *rate score,* find the sum of the rate values of all the exercises which the pupil has attempted. (The rate value is found at the left of the exercises.) If the pupil has omitted an exercise, include its value in the sum because the pupil probably read it.

3. In finding the *comprehension score* every exercise is counted as either wholly right or wholly wrong. The correct answers are given below. Where the pupil's answer is not correct, cross out the comprehension value of the exercise. (The comprehension value is printed at the right of the exercise.)

4. Add the comprehension values of the exercises answered correctly. This sum is the pupil's comprehension score.

Correct Answers for the Exercises

If the pupil is asked to underline a word, the word must be underlined and not have a circle drawn around it or a check mark placed after it, in order for the exercises to be counted as correct. If the pupil is asked to draw a line around a word, the word must have a line drawn around it in order for the answer to be counted as correct.

In certain of the exercises, no directions are given for indicating the word and any kind of an indication, a line under the word, a line around the word or a check mark is counted as correct.

TEST I — FORM I

1. Hollow tree.
2. Dame-schools.
3. Red.
4. A line under grandmother.
5. Logs.
6. In a sandhill, or sandhill.
7. No.
8. In the spring, or spring.
9. On the top of the roof, or on the roof.
10. Hay.
11. A line under carp.
12. A line around unhappy.
13. A line under low.
14. “Croak, croak,” or “Croak”
15. A line under foolish.
16. A line under child.

TEST II — FORM I

1. Oil.
2. Stars, or the stars.
3. October.
4. Shepherd.
5. North America.
6. A line around forest.
7. Cross out ruler.
8. One.
9. A line under air.
10. A line under bleak.
11. A line under brave.
12. A line under lazy.
13. Calmness.
14. A line under downhearted.

The preceding method of scoring comprehension as given by Monroe is valuable in that it gives the child's ability as compared with established norms. For the purposes at hand it may be advisable to go over this test a second time and score it in a more liberal fashion. In those instances where the child has misinterpreted directions but has got the meaning of the selection, partial credit may be allowed. Usually there will not be large differences in the results of the two methods, but in a few cases the variation in the two scores may be sufficient to be of *interest.* Large differences of this type may indicate haste, carelessness, or lack of ability to follow directions. The results of the scoring should be recorded in the place provided on page 341.

In some instances an index of comprehension may prove to be of value. This means the relation of the number of selections attempted to the number which were answered correctly. This relation may be expressed either as a decimal or as a common fraction.

DIRECTIONS FOR SCORING GRAY'S ORAL READING TEST

BY W. S. GRAY

1. Score the results for each paragraph through the use of the following table. The numbers in the left-hand column refer to the number of seconds required to read a paragraph. The numbers in the horizontal line at the top of the table refer to the number of errors made in reading. The numbers in the horizontal line to the right of 40 mean that if a paragraph is read in 40 or more seconds with no errors a credit of 4 is given; with 1 error, a credit of 4; with 2 errors, a credit of 3; with 3 errors, a credit of 2, etc.

SECONDS	ERRORS							
	0	1	2	3	4	5	6	7 or More
40 or more	4	4	3	2	1	0	0	0
30–39	4	4	3	2	1	1	1	0
25–29	4	4	3	2	2	1	1	0
20–24	4	4	3	3	2	1	1	0
19 or less	4	4	4	3	2	1	1	0

To find the score for a given paragraph, note the time required to read it and the number of errors made. For illustration, paragraph 1 may be read by pupil A in 34 seconds with 3 errors.

In the left-hand column of the table find the time unit which corresponds to 34 seconds. Evidently it is the time unit 30–39.

Follow the horizontal line of numbers to the right of 30–39 to the column which represents 3 errors. The score indicated there is 2.

Enter this score on the score sheet in the column for paragraph 1 opposite the reader's name.

The score for each paragraph should be determined and entered in the same way. Make no entry on the score sheet if the score is 0.

(*a*) Enter the total score for each paragraph in the column under "Score" in the following table:

Paragraph	Score ×	Value	Product
1	....	....	
2	....	5	
3	....	5	
4	....	5	
5	....	5	
6	....	5	
7	....	5	
8	....	5	
9	....	5	
10	....	5	
11	....	10	
12	....	5	
Total product.....			

VALUE FOR PARAGRAPH I

Grade	
I	55
II	35
III	30
IV	25
V	20
VI	15
VII	10
VIII	5

(*b*) The value or credit given for the successful reading of paragraph 1 varies with the grade. These values are given in the column to the right of the table. Enter the appropriate value for paragraph 1 in the blank space in the column under "Value." Thus, the appropriate value for paragraph 1, for the third grade, is 30. The values for all other paragraphs remain the same for all grades.

(*c*) Multiply the score for each paragraph by its value and enter the result in the column under "Product."

(*d*) Divide the sum of the products by 4. The result is the individual score.

(*e*) Record the results in the record sheet for oral reading on page 342.

DIRECTIONS FOR DETERMINING THE ORAL RATE

In many cases the rate of oral reading is of great importance in the process of diagnosis. Unfortunately methods for determining the oral rate from Gray's scale are not well developed. Lloyd and Gray have used paragraph 3 as a measure of rate for the third grade. In the same way paragraph 5 was used for grade four, paragraph 6 for grade five. The same authors consider a rate of less than two words per second as slow; a rate of two and three tenths words per second as fair; and a rate of *three* words per second as high. Record on page 342.

ERRORS IN ORAL READING

A study of the various types of errors is also a very great aid in the diagnosis of certain cases. The only norms which are available are in terms of percentages. In order to determine such a percentage, divide the number of any single type of error by the total number of errors. For example, if a child makes ten errors and five of these are omissions, the percentage is fifty. Such results may be recorded on page 341. The various types of errors may be studied by means of the outline on page 257.

DIRECTIONS FOR SCORING THE QUALITY OF ORAL READING

Directions for giving grades upon pitch, pronunciation, etc. Consider the different points to be defined as follows:

1. Poise refers to the freedom which the subject seemed to feel in the reading. For a number of superfluous movements and other signs of embarrassment a low grade should be given; if the subject seems perfectly at ease, a high grade should be given. It is important to distinguish between lack of poise that is habitual with the subject and that produced by the conditions of the experiment.
2. Pitch is included in the list because some readers raise their voices in a marked degree when they read. Before the test begins, the experimenter should talk for a time with the subject so that the natural tone of voice may be observed. A low grade is to be given if the voice is raised above the natural tone except when the reading requires it.
3. Articulation refers to the accuracy with which the different sounds are produced.
4. Pronunciation refers to completeness and correctness of the enunciation of the word, such as the sounding of a final *s* or *ing*.
5. Emphasis refers to the stress which is put on certain words or phrases to make the meaning clear.
6. Force refers to the amount of energy which is put into the reading as a whole.
7. Interpretation, as used here, refers to the ability of the reader to show by emphasis, inflection, pauses, etc., that the meaning of the author is appreciated.
8. Record your grades in the proper place on the record sheet, page 342.

DIRECTIONS FOR SCORING STARCH'S SILENT READING TEST

ADOPTED FROM STARCH'S WORK

To score comprehension by this test, go over the paper written by the pupil and mark out all incorrect and irrelevant material. Then count the words which remain. This number is the score of comprehension.

To score this test for rate, divide the number of words read by thirty.

Record the results in their proper place on page 342.

DIRECTIONS FOR SCORING THE SPEED TEST

This test may be scored for comprehension in the same manner as the Starch test.

To obtain the rate, divide the time required for reading expressed in seconds into the number of words in the passage read. The number of words in each selection is as follows:

Selection 1,	95
Selection 2,	102
Selection 3,	117

Record the results in the proper place on page 342.

DIRECTIONS FOR SCORING THE OUTLINE TEST

The points listed below may be taken as correct topics. If the child gets the thought expressed by these topics, credit him with the point. Count all answers as either right or wrong. If any point is doubtful give the pupil the benefit of the doubt. Express the results as percentages. For example, if the pupil gets three out of four points the score is 75 per cent.

In order to determine the rate, divide the time required for reading expressed in seconds by the number of words in the selection. Record results on page 342.

1

Number of words, 180

1. The blood carries food for the body as commodities are sent over the country by railroads, canals, etc.
2. The food is manufactured into blood.
3. There are tubes in the body which have the blood flowing through them.
4. The heart forces the blood through these tubes.

2

Number of words, 165

1. The personnel of the party.
2. A description of the fields.
3. A description of the woods.

3

Number of words, 204

1. The simplest attempts.
2. The pool.

Directions for Scoring the Direction Test

By Pintner and Toops

A score of one should be given for each direction correctly answered. The total possible score in this test is therefore twenty. The following quotation taken from Pintner and Toops' work gives detailed directions for scoring this test:

> A direction had to be literally correct before a score was allowed. Direction 1 was given credit only when some sort of a mark crossed out the *g* and the *g* only. Direction 2 received credit only for the figure 2 placed between the two dots, the word *two* not receiving credit. Direction 3 received credit for the answer *three*, 3, or *three feet*, etc., or any answer conveying the idea three. No. 4 received credit only for the sign "+" written *above* "yesterday," no credit for × or for any other sign or any other position than *above* "yesterday." No. 5 had to have the dot fairly below the black line.

Credited responses to direction 6 are "7" or "seven" *with* or *without* drawing the addition bar, and the answer placed in any position with respect to the two figures to be added. In direction 7, credit was given when *n* or *N* was added to the end of *Joh*, but no credit was given for writing out the word *John* and neglecting to complete the partial *Joh*. No. 8, credit for either × or + in the circle. No. 9, credit for *e* or *E*. No. 10, credit only for the figure 7, not for the word *seven*, in the largest square. No. 11, credit for any mark through *X* only. No. 12, credit for *G* or *g* (perhaps a slight deviation from our principle of literal exactness). No. 13, credit for two dots placed anywhere between the two lines. No. 14, credit only for = placed in the proper place, no credit for − or +, etc. No. 15, credit for *e* or *E*. No. 16, credit for any mark filling up the greater portion of the blank left in the outline. No. 17, credit for *X* in the proper place. No. 18, credit for a dot anywhere in the lower one-third area of the circle below the dot in the center. No. 19, credit for any shaped line inclosing the three dots only. No. 20, credit for a horizontal line through *sentence* or for any mark crossing out *at least two* of the letters, no credit for any line crossing out only one letter as in *sentence*, because this is a response to a misinterpretation of the direction whereby *letter* is understood instead of *word*. Record results on page 343.

DIRECTIONS FOR SCORING THE NEWSPAPER TEST

This score should be thought of in terms of method. If the child glances down each column and proceeds as if he knows what he is about, he may be scored excellent. If he glances over the page looking for each title but in too hasty a manner, he may be scored good. If he inspects each column in a manner which is too detailed or proceeds without any system, he should be scored as poor. Record results on page 346.

DIRECTIONS FOR SCORING THE TRABUE LANGUAGE TEST

BY TRABUE

The following detailed directions for scoring this test have been worked out by Trabue:

1. We like good boys —— girls.

Score 2	and, an, und
Score 1	or, not, and good, also
Score 0	for, with, said the, and the

6. The —— is barking at the cat.

Score 2 dog, hound
Score 1 dogs, boy, dog
Score 0 man, cat, god

8. The stars and the —— will shine to-night.

Score 2 moon
Score 1 light, planets, lights
Score 0 dipper, stripes, clouds, city, sky, sun

22. Time —— often more valuable —— money.

Score 2 is, was, . . . than
Score 1 seems, becomes, . . . than
Score 0 are . . . with, is . . . with

23. The poor baby —— as if it were —— sick.

Score 2 cries, cried, acts, acted } * very, getting } **
lies, lay, looks, looked } . . . quite, extremely }

Score 1 suffers, suffered, appears, moans, sighs } . . . **
lays, feels, behaves, was crying, groans }
acts, looks, plays, . . . never
*. . . { feeling, nearly, dangerously, rather, almost
real, awfully, terribly, pretty, half, home, sea
bad, about, often, so

Score 0 *. . not, was . . . very,

31. She —— if she will.

Score 2 can, may
Score 1 will, may go, can do well
Score 0 does, works, goes, has, is, could, knows, might, plays. is good, can't.

35. Brothers and sisters —— always —— to help —— other and should —— quarrel.

Score 2

should . . . { try, strive, offer, seek, agree
endeavor, learn, aim, attempt, want } *. . . each . . . { not
never } **

Score 1

must . . . * . . . each . . .**
should . . . { consent, like, go, work, love, be ready, come, have, wish } . . . each . . .**
are . . . { glad, happy, willing, eager, ready, expected, able, supposed, told, bade, careful, good, apt, trying, together, best, needed } . . . each . . .**
should . . . * . . . the, an, one, one an, . . .**
nearly . . have . . . each . . .**
ought . . . to try . . . each . . . **
most . . .* . . . each . . .**

Score 0

should . . .*. . . out, along, some, . . .**
can . . . go . . . one . . .**
are . . . ready . . . one . . .**
have . . . had . . . each . . .**
are . . . kind . . . each . . .**

38. —— weather usually —— a good effect —— one's spirits.

Score 2

{ cold, pleasant, balmy, frosty, winter, bright, clear, moderate, brisk, spring, fair, cool, mild, warm, autumn, beautiful } *. . . has . . . { on, upon } **

Score 1

*. . . had . . .**
{ summer, good, fine, nice, the, hot, sunny, calm, rainy, temperate, this, such, damp, windy } . . . has . . .**
*. . . takes, produces, . . .**
summer, good, . . . has . . .**

Score 0

*, summer, damp, bad, . . . has, is, . . . to, in
*. . . makes, shows, . . .**
*. . . gives . . . to,
bad . . . has . . .**

48. It is very annoying to —— —— toothache, —— often comes at the most —— time imaginable.

2

ve . . . (a, the,) *. . . which . . . { trying, unexpected, absurd inconvenient, embarrassing annoying, unwelcome, unusual, distressing, extraordinary, disagreeable, inopportune, undesirable, unfortunate, unsuitable, unreasonable, objectionable } **

ffer . . . from, with, . . . which . . .**

1

t, feel, suffer, bear, . . .*. . . which . . .**

ve . .*, . . . which . . . { horrid, awkward, terrible, critical unpleasant, busy, strange, important, unthinkable, peculiar, unlucky harmful, valuable; strange, unlikely unsatisfactory, unprepared, uncertain, awful, queer
ffer . . . from

ve . . .*. . . for it, as it, and it, that it, that, it, . . .**

0

ve . . .*. . . and . . .**

ve . . .*. . . which . . . { unknown, pleasant, happy, joyful, worst, sudden

. To —— friends is always —— the —— it takes.

2

ve, make, win / in, be, help, keep } * . . . . worth . . . . time, effort, trouble

1

, satisfy, meet, greet, know, please, find / at, visit, entertain, possess, obtain } . . . worth . . .**

. . worth . . . endeavor, energy, pains, patience, work

0

. . for, worthy, of, . . .*

n, . . . better . . . longer,

r . . . given . . . best,

asterisk following a bracketed group of words indicates that this group rds will be indicated thereafter by an asterisk alone. Double asterisks, asterisks, etc., are also used to refer to and stand for entire groups rds.

cord results on page *343*.

DIRECTIONS FOR SCORING THE THORNDIKE WORD TEST

ADOPTED FROM HAGGERTY'S WORK

It should be noted that this test is composed of various lines of words. Each word in any one of these lines has about the same value or degree of difficulty as any other word. In order to score the test, mark the paper for the number of wrongly marked and omitted words in each line. The highest numbered line which the child does with one or no omission or error is taken as his score or measure. The results below show one pupil's record in this test. A detailed study of the test sheet should also be made.

	Line	4	5	6	7	8	9	10	10.5	11
Pupil	C	0	0	0	0	1	3	3	4	3

It will be of interest to note the type of word upon which the pupil fails. The time should also be considered as an index of the pupil's ability, although the author does not take this into account in his method of scoring. Record results on page 343.

DIRECTIONS FOR SCORING THE PERCEPTION TESTS

THE SHORT EXPOSURE TEST

The child may be scored one for each word which he gets correct. If he reports a word which occurs in a sentence but gets the word out of order, a score of one-half may be given. The final score is the total number of words reported correctly.

Record the results in the blank form on page 343.

THE EYE-VOICE TEST

Score one point for each word reported correctly. If a word is out of order but is correct, one-half may be credited. The final score is the total number of words reported correctly.

Record the results in the form on page 343.

CHAPTER XX

METHODS OF RECORDING AND INTERPRETING RESULTS

This chapter contains blank forms for recording the results obtained by the various tests and methods of observation previously discussed. In addition to this, interpretations are made of certain typical cases. These interpretations give a diagnosis of such cases and are based upon results procured by the method outlined in the discussions which precede. Records for two pupils are given in a part of the tests. One of these pupils is from the fifth grade and the other from the sixth grade.

RECORD BLANK FOR MONROE SILENT READING TEST

Standards by Monroe

GRADE	3	4	5	6	7	8
Standard Score Comprehension	7.2	13	19	20	23	26.4
This Pupil Strict Method			15.8			
This Pupil Liberal Method			18.5			
Standard Score Rate	52	73	89	88	99	106
This Pupil			8.7			
ndex of Comprehension			9/11			

RECORD SHEET FOR ERRORS IN ORAL READING

Percentages by McLeod

GRADE	REPETITIONS		INSERTIONS		SUBSTITUTIONS		OMISSIONS		MINOR MISPRONUNCIATIONS		GROSS MISPRONUNCIATIONS	
	Average Number	This Pupil	Average Number	This Pupil	Average Number	This Pupil	Average Number	This Pupil	Average Number	This Pupil	Average Number	This Pupil
3	14.2		11.1		28.2		4.9		23.3		18.1	
4	20.2		7.5		30.8		8.0		21.8		11.6	
5	18.1	15.8	6.6	5.2	24.6	0	4.7	21	32.0	26.3	13.8	31.5
6	11.1	21.7	6.1	4.3	20.6		9.0	6.5	36.3	45.6	16.7	21.7
7	13.2		8.8		26.4		8.2		31.4		11.8	
8	16.8		7.0		18.9		4.7		41.9		10.5	

ELEMENTS IN THE QUALITY OF ORAL READING

Poise ——
Pitch ——
Articulation ——
Pronunciation ——
Emphasis ——
Force ——
Interpretation ——

RECORD BLANK FOR GRAY'S ORAL READING TEST

Standards by Gray

GRADE	3	4	5	6	7	8
Standard Score........	46	47	48	49	47	48
This Pupil............			42.5	38.2		
Rate of Oral Reading...						

RECORD BLANK FOR STARCH SILENT READING TEST

Standards by Starch

GRADE	3	4	5	6	7	8
Standard Rate Score.........	2.1	2.4	2.8	3.2	3.6	4.0
This Pupil..................			5.0			
Standard Comprehension Score	24	28	33	38	45	50
This Pupil..................			66			

RECORD BLANK FOR SPEED TEST

GRADE	3	4	5	6	7	8
This Pupil Rate.............				2.3		
This Pupil Comprehension....				26.1		

No standards are required here. Compare these results with those of other silent reading tests The Starch Test is of special interest in making such a comparison.

RECORD BLANK FOR OUTLINING TEST

SELECTION	1	1	2	2	3
Grade	4	5	6	7	8
Standard Score....................	45	47	30	50	
This Pupil........................			25.0		
Standard Rate Score...............	2.5	2.6	2.9	3.0	
This Pupil........................			1.7		

RECORD BLANK FOR DIRECTION TEST

Standards by Pintner and Toops

AGE	8	9	10	11	12	13	14
Standard.............	7	18	18	18	18	19	19
This Pupil............					15	17	

RECORD BLANK FOR TRABUE LANGUAGE TEST

Standards by Trabue

GRADE	3	4	5	6	7	8
Median Score.........	8.0	10.0	11.4	12.4	13.4	14.4
This Pupil...........			10			

RECORD BLANK FOR THORNDIKE'S VISUAL VOCABULARY TEST

Standards by Haggerty

GRADE	3	4	5	6	7	8
Median Score.........	4.0	5.2	6.0	6.6	7.2	7.9
This Pupil............			4			

RECORD SHEET FOR SHORT-EXPOSURE TEST

	Number of words exposed	Number of words reported	Number of words incorrect	Number of words correct
1	2			
2	3			
3	6			
4	4			
5	6			
6	4			
7	7			
8	6			
9	5			
10	3			
11	4			
12	7			
13	2			
14	5			
15	3			
16	5			
17	2			
Total				

GRADE	3	4	5	6	7	8
Norm	34.3	38.6	40.9	40.2	45.2	
This Pupil			12	21		

RECORD SHEET FOR VOICE-EYE TEST

Selection	Number of words reported	Number of words incorrect	Number of words correct
1			
2			
3			
4			
5			
6			
7			
8			
Total			

GRADE	3	4	5	6	7	8
Norm	14.1	22.2	22.3	31.0	31.1	
This Pupil			19	24		

RECORD SHEET FOR RATE OF PRONOUNCING

To determine the rate of vocalization divide the time in seconds by thirty, the number of words.

	Time	*Rate*	*Errors*
First List	——	——	——
Second List	——	——	——
Third List	——	——	——
Average	——	——	——

GRADE	3	4	5	6	7	8
Norm	1.4	1.6	1.9	2.0	2.0	
This Pupil			1.8	1.6		

RECORD SHEET FOR COUNTING TEST

To determine the rate divide the total number counted by fifteen, the time.

Total number counted —— Rate of counting ——

GRADE	3	4	5	6	7	8
Norm	4.2	5.3	4.8	5.1	5.2	
This Pupil			7.3	6.0		

Record Sheet for Eye-movement

Silent Reading

	Selection		Selection		Selection	
	Forward Movement	Regressive Movement	Forward Movement	Regressive Movement	Forward Movement	Regressive Movement
[....						
2....						
3....						
4....						
5....						
6....						
7....						
8....						
9....						
[o...						
ge..						

Grade	3	4	5	6	7	8
for Forward vement.......	10.0	9.1	10.0	7.5	7.8	
Pupil.........			'5.7	15.4		

Length of Pauses

——— Medium ——— Long ———

narks:

Record Sheet for Eye-movements

Oral Reading

	Selection		Selection		Selection	
	Forward Movement	Regressive Movement	Forward Movement	Regressive Movement	Forward Movement	Regressive Movement
....						
....						
....						
....						
....						
....						
....						
....						
....						
o...						
ze..						

GRADE	3	4	5	6	7	8
Norm for Forward Movement		13.3	9.3	9.0	10.6	
This Pupil						

Length of Pauses

Short ——— Medium ——— Long ———

Remarks:

SUMMARY SHEET

ORAL READING ABILITY	Very Low Efficiency	Low Efficiency	Average Efficiency	High Efficiency
Gray's Score		×		
Quality of		×		
Errors		×		
Rate		×		
SILENT READING ABILITY				
Monroe's Test				
Starch's Test				
Speed Test	×			
Outline Test			×	
Language Test				
Direction Test			×	
Word Test				
Newspaper Test			×	
PERCEPTION TESTS				
Short Exposure	×			
Voice-eye Test		×		
MOTOR TESTS				
Rate of Counting				×
Rate of Pronouncing		×		
Amount of Vocalization				×
Breathing Coördinations			×	
Vocal Movements				×
Extraneous Movements			×	
Eye-movement Pauses	×			
Regressive Movements	×			

The preceding record sheets show results in each case for a single test or method of observation. In order to be able to deal with the data more conveniently it is necessary to record it on the summary sheet. On this sheet the data are all expressed in similar terms. The results of the various tests are expressed in terms of efficiency. In order to do this it is only necessary to judge as to the degree of efficiency which the results of any single test indicate. Four different degrees have been provided in the blank form. These are: very low, low, average, and high efficiency. These estimates should be the last step in the process of recording and should be arrived at only after a careful study of the entire reading process has been made. The chief value of such a sheet lies in the fact that it brings together all the data available in a compact form so that the examiner can deal with it more conveniently.

INTERPRETATION OF RESULTS

The data collected have now been reduced to a form which shows whether the subject ranks low, medium, or high in the different tests and experiments which have been used. It is now necessary to interpret these results or to determine the causes of the results so far obtained. This is not always an easy thing to do, and sometimes it is not possible to determine the reasons for certain conditions. In order to facilitate the interpretation of results, the outline of the relations existing among the various factors in reading ability as discussed in a preceding chapter is reproduced. It should be used in the following manner. Suppose that the pupil under consideration is slow in his rate of oral reading. If his records for the perception test show this phase of his reading to be at fault, place a check after span of perception; but if his records show that this factor is not at fault, then pass this point to the next. If it is decided that span of perception should be checked at this point, then pass down to the place in the table where span of perception appears as a heading and determine what factor or factors have produced the difficulty in the span of perception. In this way it is possible to determine those factors, the underdevelopment or overdevelopment of which has produced the difficulties in the reading of the pupil under consideration. When used in this manner, the outline becomes a diagnostic chart. The results serve as a basis for determining the particular type of remedial work which should be used.

A discussion of the pupils whose records have been given in the various blank forms in this chapter will now be given. One of these is in the fifth grade and the other is in the sixth grade. The results for the sixth grade pupil will be discussed first.

CASE 1

This case was rather difficult to diagnose and required the use of many of the tests and observations which have been outlined. This child is the son of a successful lawyer and has always had good school training. His physical condition is excellent, and his reactions as shown in games are all that could be desired. In school work his best grades are made in manual work. In reading and in other subjects where language is involved his work has always been poor, and considerable individual attention has been necessary both on the part of teachers and of parents in order to prevent his failing in these subjects. He stated that he did not like to read and that he did not read very much.

DIAGNOSTIC SHEET

	This Pupil
I. RATE OF ORAL READING	
1. Lack of Assimilative Power	×
2. Slow Rate of Vocalization	
3. Lack of Familiarity with Language Forms	×
4. Short Span of Perception	×
5. Too Great Dependence upon Objective Cues	
6. Overcare	
II. RATE OF SILENT READING	
1. Faulty Eye-movement	
2. Lack of Assimilative Power	×
3. Large Amount of Vocalization	
4. Lack of Familiarity with Language Forms	×
5. Short Span of Perception	×
6. Overcare	
7. Lack of Effort	

DIAGNOSTIC SHEET—*Continued*

	This Pupil
I. OMISSIONS IN ORAL READING	
1. Fields of Perception do not Overlap	
2. Reading from Context	
3. Fluctuations of Attention	×
V. REPETITIONS IN ORAL READING	
1. Habitual	×
2. Dissatisfaction with First Attempt	
3. Too Great Overlapping in the Fields of Perception	
V. INSERTIONS IN ORAL READING	
1. Reading from Context	
2. Fluctuations of Attention	×
3. Apperceptive Processes too Active	
I. MISPRONUNCIATION IN ORAL READING	
1. Faulty Perception	
2. Lack of Familiarity with Language Forms	×
3. Special Defects	
4. Apperceptive Processes too Active	
I. SUBSTITUTIONS IN ORAL READING	
1. Reading from Context	
2. Faulty Perception	
3. Apperceptive Processes too Active	
I. QUALITY OF ORAL READING	
1. Failure to Appreciate Language Relations	×
2. Lack of Training	
3. Slow Assimilation	×
I. COMPREHENSION	
1. Slow Assimilative Power	×
2. Failure to Evaluate Different Ideas	
3. Poor Motor Adjustments	
4. Short Span of Perception	×
5. Lack of Language Ability	
6. Lack of Synthetic Ability	
7. Lack of Analytic Ability	
. FAULTY EYE-MOVEMENTS	
1. Short Span of Perception	×
2. Periods of Confusion	×
3. Poor Motor Coördinations	
. BREATHING	
1. Nervousness	
2. Poor Motor Coördinations	
3. Habitual	
4. Lack of Training	

DIAGNOSTIC SHEET—*Continued*

	This Pupil
XII. RATE OF VOCALIZATION	
1. Slow Reaction Time	
2. Lack of Familiarity with Language Forms	X
XIII. AMOUNT OF VOCALIZATION	
1. Habitual	
2. Accompaniment of Meaning	
XIV. EXTRANEOUS MOVEMENTS	
1. Nervousness	
2. Habitual	
3. Lack of Adjustment to Reading Situation	
XV. VOCAL MOVEMENTS	
1. Habitual	
2. Defects in Speaking Parts	
XVI. SPAN OF PERCEPTION	
1. Faulty Training	
2. Slow Assimilation	X
3. Low Level of Attention	
XVII. VOICE-EYE SPAN	
1. Faulty Training	
2. Slow Assimilation	X
3. Low Level of Attention	

The first results for silent reading were obtained by a test similar to the Starch test. This test indicated a rate of 1.6 words per second and resulted in a reproduction score of 40.9 per cent. A later silent reading test based upon questions gave a rate of one word per second and three questions out of five answered correctly. The results for each of these tests were much lower than those for other children who were doing the same school work as the pupil under consideration.

An examination of the record sheets for oral reading shows that the results in this test are for the most part poor. In only two types of errors has he a lower percentage than the average, while the percentage for mispronunciation is higher. The rate of reading in this oral test varies from 3.2 words per second for selection 1 to .6 words per second for selection 12. The

for selection 6 is 2.1 words per second and for selection
8 words per second. These rates are slow for a pupil
is grade. The large number of mispronunciations, taken
the slow rate, indicates a fundamental lack in vocabulary.
ne of his teachers suggested in her report that he did not put
cient effort into his work. In order to see the effect of greater
d upon his reading process, the speed test was given. The
lts in this test are even lower than in the tests already dis-
ed, and indicate that greater effort which undertakes to
luce greater speed is not effective.

n examination of the results for both the silent and oral
ing tests shows that the rate is about equal in the two cases.
interpretations are possible for this. The first is that the
il is not able to differentiate between the methods of oral
silent reading. However, the fact that no vocalization is
d in his silent reading practically eliminates this possibility.
second explanation is that he has such a poor knowledge of
uage relations and language forms that it is impossible for
pretation to take place faster in silent reading than in oral
ing.

th tests of perception indicate a short span. In the voice-
test he got only twenty-four words, which is about twenty
cent below the standard; and in the short-exposure test he
nly twenty-one words, which is only about fifty per cent of
orm. There seem to be two possible explanations for these
lts. One of these is that he was not sufficiently familiar with
uage forms to be able to deal with them in a rapid and
rate manner. The other explanation is that he is slow in
nilation which involves printed language.

e data for the counting test indicate that the slow rate
h has already been pointed out is not due to slow reaction
. On the other hand, the results for the pronouncing test
below the standard. As indicated in the diagnostic sheet
e 348) this is probably due to slow assimilation or to a lack
miliarity with language forms.

The very large number of eye movements can indicate only a fundamental difficulty. These records were taken by means of photography; in some places they indicate clearly periods of confusion, while at other points there are indications that words have been spelled. Many of the pauses are exceedingly long and many regressive movements are made.

An examination of the summary sheet (page 346) shows that in only a very few phases of reading does this pupil rank above low efficiency. In the direction test he is ranked as average. This is significant, because this test does not depend upon language ability except in a slight degree. Some other phases of reading ability in which he is ranked average or better are different motor phases of the reading process, which apparently are not closely related to his difficulty.

A further interpretation of these results is given in the diagnostic sheets, page 348. It is the purpose of this outline to indicate some of the fundamental processes in reading ability. Under the rate of oral and silent reading three causes may be assigned in this case for the poor results. These causes are slow assimilative power, lack of familiarity with language forms, and a short span of perception. Under heading XVI of the same outline it is seen that the only feasible reason which can be assigned for a short span of perception in this case is slow assimilative ability. This leaves only two factors as contributing to the results. The question may now be raised as to the relation which exists between these two factors. According to the boy's own testimony, he did not like to read; therefore he read but little. This is probably one of the main reasons why his vocabulary was limited and why he seemed to fail in other phases of language work. This leaves, then, the final cause as slow assimilation.

There is one other factor in the case which needs consideration. According to his teachers, he lacked concentration of attention. If this child assimilated as slowly as the results seem to indicate, it is easy to see that if he attempted to read at the same rate as his classmates, he would not be able to get the thought. This would certainly result in lack of interest and fluctuations of attention.

Emphasis should be placed upon the fact that the type of assimilation which seemed to be lacking in this case is a highly specialized type of mental activity. It is the assimilation which goes along with printed language that seems to be in question. Those types of assimilation which accompany play, manual activities, or other types of activities in which printed language plays a small part seem to give the child little difficulty.

Two types of training were given in this case. One of these had for its purpose the increasing of the span of perception and the second the increasing of speed. The first type of training showed no results. The second resulted in a considerable increase in speed and a slight increase in comprehension. A marked improvement was to be seen in the eye-movement records taken after the practice. These results are shown in Table XXI.

TABLE XXI

SHOWING IMPROVEMENT IN EYE-MOVEMENT RECORDS AFTER SPEED DRILLS

Average Number of Pauses	Average Length of Pauses	Average Number of Regressive Movements
15.5	15.4	4.5 (before practice)
6.1	12.6	1.2 (after practice)

A study of this case has been included because experience in this type of work indicates that there are many readers of this type. They are usually considered as dullards or as very backward pupils and on this assumption they are often dismissed from the mind of the teacher. One difficulty which such readers encounter in their work is that they are nearly always required to work in a hurry. If they are not hurried by their teacher, they work in an environment which hurries them. From this standpoint it may be that the training in speed given the pupil was not the proper training. It is possible that this child is one who cannot hurry and should therefore not be hurried.

Another type of training which suggests itself for children of this type is to encourage them to reduce the speed of their reading to the point where assimilation can take place. That is, if the difficulty is one of slow assimilation such a difficulty should be decreased if the rate of reading is made sufficiently slow.

CASE 2

The child whose record is reported in the spaces provided for in the fifth grade has a difficulty in reading which is entirely different from that of the pupil just discussed and which is more easily diagnosed. This child is the son of a high-grade laboring man. Both parents are much interested in the welfare of the boy, and the mother has had frequent conferences with his teacher concerning his difficulty in reading. The boy is normal in every respect and has never failed in his school work. However, he was reported by his teacher as a very unsatisfactory reader. A conference with the teacher revealed that the pupil's difficulty was for the most part in oral reading. The chief fault was that he left out entire groups of words. With respect to silent reading, she reported that he read very rapidly (apparently too rapidly in many instances), and that he seemed to understand what he read in this manner. She also commented upon the fact that he held a very high opinion of himself and of his own work. The first time that the writer saw the boy, the information was volunteered by him that there was something wrong with his eyes because he left out words when he read. He said further that he had had them examined by a doctor, but that no defects were found. Careful tests of his vision by the writer revealed no defects which could possibly account for his leaving out three or four words at a time, as he often did.

Through an oversight of the examiner, the first test given him was the Monroe Silent Reading Test for grades six, seven, and *eight*. He finished this test in four minutes, but did not get a single exercise right. On the following day he was given the Monroe Test provided for the fifth grade. The results for this test as shown on page 341 indicate that the pupil is slightly below standard both with respect to rate and comprehension. The results for the first test were probably due in part to the fact that he is a rapid reader and in part to the fact that the mention of rate in the directions stimulated him to read entirely beyond his capacity. The results for the second test may be attributed to the fact that the examiner told him that he had read too rapidly on the day before. It is probable that the results of the Starch Test on page 342 represent his normal reading. In this test both the rate and comprehension scores are much above the standards. An examination of the record sheet for this test, however, indicates that the reading has been somewhat too rapid for accuracy.

The chief point of interest in the results of the oral test is the very large percentage of omissions. The words omitted were for the most part words which were not essential to the meaning. The score in this test also indicates a lack of vocabulary. This result is corroborated by the results of the vocabulary test on page 343. The lack of vocabulary is probably due to the fact that the child, according to his own testimony, had had few opportunities to read in any extensive way, although he expressed a keen interest in historical material.

The results for the Trabue Test indicate that the pupil has good control of the language relations involved in this test, while in the case of the direction test the standard is not reached. Both of the perception tests show results which are far below standards and raise the question as to how one who is endowed with such a short span of perception can read as rapidly as this pupil does. The counting and the pronouncing tests add little to the solution of the problem. The eye-movement records on page 345 indicate a rapid and well-developed method of reading.

The diagnosis of the case appears easy, and it does not seem necessary to use the summary and diagnostic sheets. This pupil is evidently one who has developed a rapid silent reading rate in spite of the fact that he is somewhat limited in vocabulary and in the span of perception. These handicaps mean in the majority of cases a slow and tedious rate of reading, but in the case of this pupil these handicaps do not bring about such results. As suggested before, the chief fault which attached to his reading was that he left out words in oral reading. It is probable that this was due to his short span of perception, which did not allow the fields of perception to overlap as the reading progressed. In oral reading this makes very poor reading, but in silent reading it amounts to little if the thought is not lost. The results for comprehension indicate that he is able to get most of the ideas which he reads. It is exceedingly doubtful if it would be good policy to expect this child to change his method in order that it might be more accurate and at the same time much slower.

If his method of reading could be developed to the point where he could, by means of a knowledge of language relations, sense the parts of a passage which require careful reading and the parts which could be hastened over, it would be closely akin to skimming and would evidently be highly efficient. That the pupil is developing this type of method is evidenced by the somewhat high score made in the language test and by the fact that the words omitted in the oral reading test were unimportant.

In the explanation of the results to the teacher, it was emphasized that the boy should not be criticized or scolded as he had been by his parents. Instead of this, there were good reasons why the boy was to be congratulated on his achievements. One recommendation with respect to the case was that small emphasis should be placed upon oral reading because of the effect which it might have upon rate. Another recommendation was that much silent reading should be encouraged and that this should be checked by questions or by reproduction in order that careless methods might not be adopted. In other words, the *rapid* reading was to be encouraged with the aim that eventually it would develop more and more the practice of accurate and rapid skimming.

CASE 3

Another equally interesting case will now be discussed; but in order to save space, the record of this pupil will be condensed as seen in Table XXII. This is the record of a fifth grade girl. Her school work has always been satisfactory, except that she required more time than her classmates. This resulted in her carrying on a considerable part of her school work at home. From the table it is clear that this child is a superior oral reader. She was reported by the examiner as a "beautiful oral reader." Her record in the silent reading test is much below the median for her own class, and still further below Monroe's standards. In the search for an explanation of her case, it was first thought that she made use of oral methods in her silent reading. The observations of her silent reading showed, however, almost an entire absence of vocalization and extraneous movements or any other type of activity which might indicate a lack of adjustment to silent reading. The results for the perception test are entirely satisfactory. This indicates that the span of perception is such as to make for rapid and efficient silent reading, but for some reason the child is not able to employ her full span under the conditions of reading. The explanation of her difficulty is found in the record of her eye-movements. This shows that she has

TABLE XXII

Record of Fifth Grade Girl in Various Phases of Reading

TESTS	MONROE'S SILENT		ORAL		PERCEPTION	EYE-MOVEMENT	
	Rate	Comp.	Rate	Score		Forward	Regressive
Standards.........	89	19		48	40.9		
Class Median......	76	16		48			
This Pupil.........	67	11	3	68	59.2	1 to 2	

from six to eight pauses to the line, and averages one regressive movement to each line. In some lines there are as many as two movements of this type. A reader in the fifth grade with the span of perception indicated in this case need not have so many pauses to the line. The regressive movements are also greater in number than they should be.

The best explanation of such reading seems to be that the pupil is overcareful. This is in harmony with the reports of both her teacher and her mother, who state that she is very conscientious and desires to get everything just right. She is probably a victim of the "slow and sure doctrine." She is the type of child who would consider admonitions of this type very seriously, and as a result she has developed a method of reading which may be designated as overcareful.

A reader of this type must learn to plunge ahead and must realize that reading involves the element of guessing. Before she can become a rapid reader, she will have to learn to employ her full span of perception. This will give her the benefit of partial interpretations which come from peripheral vision. The remedy in her case probably lies in the reading of the story type of material. After such reading she should not be held responsible for details of meaning. In other words, she should be encouraged to read for her own pleasure. A further remedy lies in the explanation of the faults to the pupil and to the parents. Such plans were followed out and the last report from her teacher indicated that she was making improvements, but a considerable period of time will probably elapse before the defect is entirely overcome.

One further point concerning this case should be emphasized. This is that the discovery of it was entirely accidental. It is exceedingly doubtful if any teacher or principal would report children of this type, because their work is most often satisfactory. The fact remains, however, that their methods of work are exceedingly wasteful, and it should be the business of the *school* to pick out such cases early in their development, and to employ methods which would reduce the number of them to a minimum.

CASE 4

Two cases in which the difficulty is more deep-seated will now be discussed.[1] Each of these cases is still under observation, so that detailed data concerning them are not given. One of these is a boy nearly twelve years of age. He should be in the fifth grade, but he has failed twice, so that he is in only the third grade. Because of the fact that he was about to fail again, his mother brought him to the writer's laboratory. He is a very attractive child and is from an excellent family. He is exceedingly active and is fond of outdoor life. A description of his reading process may be given in terms of the Gray oral reading scale. When given this test, he read the first passage in fifty-five seconds with three errors. The second passage was read in fifty-five seconds with no errors. The last passage which he was able to read with any degree of success was the fifth. This was read in 115 seconds with five errors. He was unable to accomplish anything with the Monroe silent reading test. A general estimate of his reading ability would be that he could read about as well as a child in the high first or low second grade.

On the short-exposure test he never got more than one word, and this only when the exposure was as much as one second. He had some knowledge of phonics and spelled many of the words which he failed to recognize. In fact, it seems that he used the motor activities involved in spelling as a basis for recognition rather than the visual form of the word.

In addition to the various reading tests a number of intelligence tests were given. In all tests of this type he measured up to, or was above, the standards. He showed the ability to express himself in writing and the ability to work at problems. The results of all the tests and examinations used revealed clearly that his chief difficulty was in dealing with printed language. Inquiry showed that he never read for himself, because he got very little meaning. His mother had made a serious mistake in doing all his reading for him.

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[1] The writer is indebted to a former colleague, Dr. L. W. Sackett, for coöperation in the study of these cases.

The explanation of the case is probably a two-fold one. First, there were two rather pronounced scars on the left side of the skull, which were results of injuries at birth. Apparently, as a result of these injuries, severe convulsions set in when the child was only a few days old and continued for several weeks. After this, the development of the child was normal in every respect. A second factor which probably enters into the case is that of left-handedness. When the child started to school he was left-handed in all activities. His teacher required him to write with his right hand. The mother reported that there developed soon after this a hesitancy in speech which had not appeared before. This hesitancy is still present. The interpretation which it seems plausible to place upon these facts is that the injuries have made it impossible for the visual memory center to function properly when the memory of words is involved. While there is not absolute word blindness, the center does not function as it should. This difficulty may have been enhanced by the chang from left-handedness. A special instructor is attempting to increase the efficiency of this pupil by intensive training. Th instructor is emphasizing the motor elements of language as a basis for recognition.

CASE 5

Another case of a very different type may be cited. This is a boy fourteen years old. His reading ability is about that of a third grade child. He stammers very badly when embarrassed. The appearance of his eyes led to an examination of them by an oculist. This revealed a bad case of double vision. According to the boy, his reading material had always appeared double This difficulty had increased during the last year because of an injury he had received in the temporal region just back of the socket for the eye. The difficulties which attend double vision had made it almost impossible for him to read, and as a result he had read only what was necessary. With proper glasses it seems that he should be able to develop into a normal reader. The oculist stated that it would be about three years before the eyes would function properly.

Other cases which differ very much from those already described might be given but the foregoing results are probably sufficient to illustrate the methods used and the results obtained. The cases cited should convince teachers of the desirability of understanding clearly the difficulties which different children encounter in their reading. Reading ability varies from child to child and to develop it properly in those instances where a deficiency exists requires an understanding of each case. To assume that every child who has difficulty in reading needs only to read more may increase the difficulty rather than decrease it.

PART III

REMEDIAL MEASURES

CHAPTER XXI

THE LITERATURE OF REMEDIAL MEASURES

The problem of the remaining chapters of the book is a discussion of those measures which are available for training pupils in order that the difficulties revealed by diagnosis may be overcome. It is remedial work which gives diagnosis its importance. Indeed, diagnosis has no value except as it leads to remedial plans.

A survey of the literature upon remedial measures shows that the development of methods and devices for this type of work has not kept pace with the development of methods for diagnosis. Some authors are content to make general suggestions upon the problem, while others give the results of certain types of training but do not give the technique in sufficient detail to be of benefit to teachers who may desire to attempt the same type of work. This probably means that a definite and refined technique was not developed for the training reported.

There is, however, a considerable body of material at hand which should be carefully studied by every teacher of reading. The work in this field divides itself into two distinct types. These may be designated as general and individual remedial measures.

GENERAL REMEDIAL MEASURES

The measures designated by this title are those changes in method which are intended to increase the efficiency of an entire class or of an entire school system. Certain contributions of this type have been made by Gray (7). He suggests that speed can be encouraged by limiting the amount of time given to reading. At another point in his discussion this author says:

Many selections may be read for the story. On the other hand, many selections should be read with more care in order to determine what the essential points are in the selection or to weigh the relative importance of the facts or to associate the facts of the selection with things which the child already knows. Pupils should be trained to read selections silently and under the guidance of special purposes.

Llewelyn (15) has found the following types of training to be effective: (1) motivation in oral reading, (2) written questions for silent reading, and (3) urging children to do outside reading. Oberholtzer (12) has emphasized the value of reading a large amount of relatively simple material in the fourth, fifth, and sixth grades. Peters (13) has tried speed drills with 207 children. The results show an increase of 18.7 per cent in speed with a slight loss in comprehension. This author also found that a definite aim for the reading increased comprehension.

Suggestions of this type indicate that, as the emphasis in reading instruction shifts more toward rapid and accurate interpretation, methods will be devised which will increase the efficiency of all pupils in these respects.

INDIVIDUAL REMEDIAL MEASURES

The methods considered here are those which are devised to increase the efficiency of an individual pupil. With respect to this problem Uhl (29) has suggested the following plan: (1) the reading of very easy and interesting material, (2) the giving of particular attention to meaning, (3) the reading of short easy sentences until they are read correctly, (4) "looking ahead" while reading, (5) a limited amount of drilling upon abstract material, and (6) the encouragement of children to do outside reading.

Another author interested in the same problem is Judd (13). One type of training emphasized in his discussions is the analysis of words. He forestalls objections to such work in the following words:

> Training a child in the analysis of words may very properly be described as *training* him in the mechanics of reading. Purely mechanical training

> is in an important sense in opposition to the purpose of the school in its efforts to make good readers. The school aims to reach the level of fluent synthetic grasp of phrases. Mechanical training does, indeed, temporarily prevent from understanding the meaning of the passages. Mechanical training would not be justified if distractions could be avoided by ready recognition of all words. Mechanics are justified when they contribute the final recognition of words.

Further types of practice suggested by the same author are training to reduce vocalization, to see phrases, to develop proper movements of the eyes, and to develop proper interest in the subject matter.

Results obtained by different methods of practice are given in detail by this investigator. Case G was given training in oral reading for six weeks. A second six weeks were given over to drill in phonics and in word analysis. In the third six weeks a great deal of silent reading was given. Each of the types of training was used at all times, but the various phases were stressed as indicated above. As a result of this training, the rate of oral reading increased from 2.4 words per second for the first six weeks to 2.7 words per second for the last six weeks, while the errors were reduced from 4.5 per hundred words read to 1.1 errors per hundred words. In teaching word analysis different systems of phonics, with variations of each, were used. In teaching silent reading, paragraphs or selections dealing with topics which were of special interest to the child were used. In some cases the selections were modified so that they contained words learned in the exercises in phonics. In other cases questions were proposed, the answers to which were to be found in the material to be read. As a result of this training, the rate of silent reading increased from 2.4 to 3.6 words per second, and comprehension increased from 22 per cent to 74 per cent.

In addition to these results, certain other effects of the training are recorded as follows:

> Her teachers report that case G reads with much greater ease and fluency of expression, the quality of her voice has improved, and the nasal tones have almost disappeared. She seems to enjoy reading silently much more

than before training. Frequently she expresses a preference for reading a passage silently, saying, "I can do it faster." Her oral reproductions contain many more of the expressions found in the original passage than formerly.

Another pupil studied by Judd is designated as Case H. This child was given much oral reading and phonic analysis with a few minutes of silent reading for the first six weeks. This training resulted in increasing the rate of oral reading from 1.33 words per second to 2.57 words per second, and the number of errors in the same passage before and after practice was reduced from 47 to 15. During a second period of six weeks silent reading was emphasized. In this training narrative material was used at first, and later informational material was introduced. The factor of personal interest was also used to advantage. After such reading, either oral or written reproduction was required.

In another part of his report Judd suggests an intensive study of words as a type of training. The term "an indomitable hero" was introduced in a selection read by one of his subjects. This led to the following synonyms and equivalent phrases:

imdomitable
courageous
resolute
manly
fearless
heroic
bold
daring
plucky
stouthearted
intrepid
audacious
defiant
undismayed

to look danger in the face
to screw one's courage to the sticking point
to take the bull by the horns
to beard the lion in his den
to put on a bold front

The training of these different children as carried out by Judd divides itself into three types. These are as follows: (1) training in word analysis, (2) training in oral reading, and (3) training in silent reading. Each type of training seems to have been given each pupil. The theory which apparently underlies such a method is that efficiency is to be attained in the case of those who have difficulty in reading by increasing the amount read and by increasing the ability to analyze certain difficulties in reading.

The writer (8) has also given training with reference to special difficulties in reading. All the subjects were selected because earlier study of their reading process had shown their individual needs. In every instance the practice extended over a period of twenty days. Twenty minutes was devoted to the work each day. Each type of training was directed by a different person, who, in each case, was a college student. The first kind of training may be designated as training in speed.

TRAINING IN SPEED

The subject was a fifth grade girl. The training consisted in having the child read selections adapted to her age and school grade. The directions required that she read as fast as possible. If necessary, this was to be done at the expense of comprehension. The results of the practice are shown in Table XXIII.

TABLE XXIII

Record of a Subject before and after Practice in Speed Reading

Selection	Time	Rate	Questions Attempted	Questions Correct	Writing Time
4.......	:27	2.5	5	3.5	2:31 (before practice)
4.......	:15	4.6	5	4.0	1:36 (after practice)
		Gain 84 per cent		Gain 14 per cent	
5.......	:46	1.7	5	2.0	2:15 (before practice)
5.......	:17	4.6	4	3.0	:59 (after practice)
		Gain 171 per cent		Gain 50 per cent	
7.......	:51	1.2	5	2.0	2:27 (before practice)
7.......	:51	3.8	3	.5	:43 (after practice)
		Gain 217 per cent		Loss 75 per cent	

This table indicates that the pupil was tested before and after practice both as to rate and comprehension. Comprehension was tested by having the subject answer questions. It will be seen that there is a very decided increase in speed in all the tests, and that there is loss in comprehension only in selection seven, which was rather difficult for a pupil of this grade. Such results indicate the possibility of more efficient reading as a result of greater effort.

TRAINING IN QUICK PERCEPTION

In this experiment the training consisted in exposing before the child short sentences for brief periods of time. The object of this practice was to determine whether the span of perception could be increased by such training.

Two different experiments were carried out. In the first of these two boys from the sixth grade were the subjects. This training failed to produce results. The second experiment was performed with two pupils in the fourth grade. In these cases there was a distinct improvement, as shown in Table XXIV.

Such results indicate that training in this phase of the perceptual processes is effective, if conducted early in the school experiences of the pupil, and that certain habits in connection with the reading activity are apparently established earlier in the school life of the child than has been supposed.

TABLE XXIV

Record of Two Subjects before and after Practice in Quick Perception

Average on 2 Words	Average on 3 Words	Average on 4 Words	Average on 5 Words	Average on 6 Words	Average on 7 Words
1.8	2.5	2.5	3.0	3.3	Omitted (before practice)
2.0	3.0	4.0	4.3	3.3	3.5 (after practice)
1.3	1.0	1.6	1.5	2.2	2.0 (before practice)
2.0	3.0	4.0	3.9	3.3	3.5 (after practice

This type of work is closely related to the training in the primary grades, which is based upon the use of flash cards. It appears that work of this kind should be much better controlled and should be given more emphasis in the early school training, which has for its purpose the development of reading ability.

TRAINING TO DECREASE VOCALIZATION IN SILENT READING

The next type of training conducted by the writer had to do with decreasing vocalization in silent reading. The subjects in this case were pupils whose silent reading might be characterized as "inaudible oral" reading. At the beginning of the practice some explanation of the effects of a large amount of vocalization in silent reading was made. The material used for the training was selected so as to be of interest to children of this age and grade. The subjects were directed to read in their normal way, except that they were to eliminate vocalization. After a few days the vocal movements disappeared almost entirely. The instructor reported great progress, and was very enthusiastic about the results. When the control tests were given, it was found that a very considerable increase had been made in rate, but that there was a decrease in comprehension. The results are shown for one of the subjects in Table XXV. The decrease in comprehension may have been due to the fact that these subjects were children whose mental activity demanded motor accompaniments or it may have been due to the fact that the decrease in the vocalization was brought about too rapidly.

TABLE XXV

Record of a Subject before and after Practice in the Decrease of Vocalization

Selection	Time	Rate	Questions Attempted	Questions Correct	Writing Time
4.......	:28	2·5	5	4·5	6:12 (before practice)
4.......	:17	4·0	4	4·0	3:28 (after practice)
		Gain 60 per cent		Loss 11 per cent	
5.......	:53	1·5	5	4·5	4:15 (before practice)
5.......	:46	1·7	5	4·0	2:40 (after practice)
		Loss 13 per cent		Loss 11 per cent	

TRAINING IN COMPREHENSION

Another type of training in the same series of experiments had to do with comprehension. The practice consisted in having the pupil read selections carefully with a view to emphasizing those elements on which the meaning depended. Such matters as topic sentences, relational words, and the effects of different types of modifying phrases were discussed. The results may be summarized as follows: (1) there was a distinct increase in rate; (2) a gain in comprehension is made in two tests by one subject, and no gain is made by the other subject. The results in the latter case were explained by the instructor as being due to the pupil's attitude toward the work. These results do not seem very encouraging, and yet it is true that where gains in comprehension were made they were greater than those shown in any other type of training. It is probably true that this phase of reading requires a longer period of practice in which to produce results than is required in any of the other phases so far dealt with.

TRAINING IN PHONICS

The last type of training to be considered had to do with phonics. Two third grade boys who showed a lack of ability to deal with new words by means of analysis were given this training. The practice was not connected in any way with their reading work; and although there was a very appreciable increase in their ability to analyze and pronounce new words, the effect was not noticeable in their reading. This makes clear the desirability of correlating any type of training with the reading activities of the pupil.

Variations of most of the preceding methods have been carried out recently by Gray (9) and Anderson and Merton (1). Two new types of remedial methods introduced by these authors are training in phrasing and training to make automatic the recognition of certain phrases which are often repeated in discourse, and training to eliminate periods of confusion. The results of the series of experiments may be summarized as follows:

1. It is clear that speed, comprehension, and vocalization can be modified in a positive way by practice. It is also true that the perceptual span can be increased if the training is given early in the child's school life.
2. There is need of careful technique for conducting the different types of practice, and instructors with experience are highly desirable.
3. How far certain types of training should be carried is an open question. This is shown by the falling off in comprehension after certain types of training have been employed.
4. Rate can be improved by different methods. Such an increase was brought about by training in rapid reading, by training in decreasing vocalization, by training in phonics, and by training in comprehension. In three of these methods speed in reading was not emphasized, and yet in each case there was a marked increase in rate. In other words, it seems that if the attention of the reader is directed to any one of these four phases of the reading process, the result is an increase in rate.

In conclusion emphasis should be placed upon one difference which seems to exist between the training employed by Judd and that used by the writer. The methods used by Judd required that all subjects be given the same general training with certain variations to meet the needs of individual pupils. The methods used by the writer are more specialized. The particular weakness of a pupil is determined, and only that training which is thought to correct this deficiency is given. The two types of training extended over periods of time which are so different that it is impossible to compare results. The first method may be designated as *indirect* in its nature, and the second as *direct*.

An objection which may be made to all the methods of training thus far discussed is that they are not practicable, because they have been based upon individual instruction and the training has been given by special teachers outside the regular reading period.

That special training in reading can be carried on in a school room by the regular teacher as a part of the daily work has been shown by Miss Zirbes (30). She gave special training to a class for a period of seven months. This training was of a nature which supplied the needs of individual pupils and was given during the regular reading recitations. This author has divided the remedial work which she employed into ten different types. She has elaborated the various forms of training as follows:

TYPE LESSON 1. All look at the first phrase, looking up when they reach a comma, or a period. When the entire group is looking at the teacher she nods and they repeat the phrase. She watches individuals to find their difficulties, but does not interrupt. When they have said all but the last word of the phrase they again look down, silently getting the next phrase and looking up, holding the phrase in mind until all are ready. Again the teacher nods and the group gives the phrase orally, looking down at the last word and continuing this procedure to the end of the paragraph or section. The intensive study calculated to improve poor readers, can be made to yield a double return, if instead of selecting hard words and subjecting them to analytic study, the unit is the phrase or group of words which expresses an idea. Instead of working at a difficult word, the phrase in which it appears is mastered. Instead of working with a child at a time and giving each child only a few minutes of actual oral reading, four or five of those who have similar ability are grouped together, while other groups of poor readers follow silently. Third grade material or very simple fourth grade material is used for this purpose.

While other pupils are being tested the ones who have had Type 1 answer mentally or in writing blackboard questions concerning the material of their lesson. Occasionally duplicated sheets containing uncompleted sentences or a story are used instead of the children filling in the blanks mentally or in writing.

TYPE LESSON 2. *Eye Training and Focus.* Field of vision enlarged to include several words rather than one. First: by having the book far enough from the eyes. Second: by eliminating the use of a finger or other placekeeping devices. Third: by work with flash cards, flashing phrases, trying to get a phrase with one flash (orally). Counting the number of flashes needed for each phrase. These phrases can be cut from current printed matter and mounted on small cards. Written sentences directing children to perform certain activities are also to be used as flash material. The one who first reads the direction carried it out. The pupil who had three such opportunities in succession was given a sheet with similar work in silent reading. This finished he returned to the group.

Type Lesson 3. Silent reading for the purpose of oral reproduction and comprehension.

Type Lesson 4. Silent reading in search of a given phrase, answer, idea, or suggestion in the content of Supplementary Books, Geography Text, Arithmetic Text and blackboard work.

Type Lesson 5. Differentiation for pupils who confuse similar words or miscall syllables, guess at words, or omit endings. Lists like the following form the basis of such work. Lists are compiled from actual mistakes made by children.

that
when
what
then
how
who
then
there
than
women
man
woman

every
never
even
ever
very
these
those
now
know
beautiful
beautifully
prettiest

prettily
probably
lovingly
companions
understand
understood
laughingly
quietly
swimming
board
close
chose

lying
buying
tired
tried
certain
curtain

Type Lesson 6. Lessons in accuracy for those who make errors, substitutions, and omissions, reading a page and counting errors, or reading until they make an error to see how many lines they can read perfectly.

Type Lesson 7. Breathing exercises. Children are taught to breathe rhythmically at ends of phrases or clauses instead of breaking the smoothness of reading. Practice in breath control is thus related to the problem of meaning and interpretation. Abdominal breathing is taught.

Type Lesson 8. Articulation exercises for mumblers, or those with voice or other bad speech habits.

Type Lesson 9. Voice work and expression. Unpleasant voice quality, and monotony corrected by special practice and training. Children are taught to vary meaning by change of stress. Punctuation is studied for the same purpose.

A pupil who was found deficient in any of these phases of reading was expected to take training in that particular phase until proficiency was attained. This means that the periods of training varied in number with the needs of the individual pupils. In addition to this, a great deal of reading was done. The plan seems to be a combination of the direct and indirect plans which have already been discussed.

The charts and graphs accompanying the article show that the progress made by the different pupils was highly satisfactory. In a personal conference which the writer had with Miss Zirbes, she emphasized the fact that such a procedure rationalized the whole reading process for the children. As a result, they saw the reason for everything they were required to do, and in this way their attitude was made very receptive toward the training.

Other training conducted by teachers as a part of the regular school work has been reported by Lloyd and Gray (16). Various types of training were summarized by these investigators and furnished in the following form to each teacher in the school system where the experiment was conducted:

I. *Intensive training in work structure*

Give training in phonics and word analysis. Train to work out unknown words syllable by syllable. As much practice in oral reading both at home and school as possible.

II. *Increased vocabulary*

This is training in word structure also, but a less fundamental type is needed. Train in the power to work out a new word. Make lists of words which pupils do not recognize immediately, for training in ready recognition and comprehension. These lists should be typewritten and frequently practiced upon by the pupil. As much practice in oral reading as possible.

III. *Training in accurate recognition*

Urge a close inspection of words before pronouncing them. Keep the thought of the selection uppermost, so that the pupil will feel the meaning destroying effect of substitutions, insertions, and omissions. This can be done by close questioning.

Let the group read competitively, counting the number of errors in a given amount of matter. Let pupils read until an error is made, to see how many lines can be read perfectly.

Use the "looking ahead" device described under VI. At the beginning of this type of training count the number of errors, including repetitions, made in reading a given passage. After two or three weeks have the same passage read as a test of the success of the training.

IV. *Differentiation of words*

This should be used in both cases I and III, that is for pupils who are being trained in the analysis of words and in accurate recognition. Typewritten lists of words like the following, compiled from the actual mistakes of children who confuse similar words and miscall syllables, should be studied and practiced upon for immediate differentiation:

that
what
when
then
how
who
then
there
every
never
even
very
these
those
they
their
now
know
close
chose
lying
buying
quite
quiet
tired
tried
certain
curtain
farmer
farming
fish
fishing
road
roads
from
for
etc.

V. *Training in quick perception*

These are methods to widen the perceptual span and quicken the recognition of familiar words:

1. See that the book is held far enough away from the eyes to take in several words at a glance.

2 Eliminate all place-keeping devices.

3. Short-exposure methods: Make flash cards by pasting on small cards phrases cut from current printed matter. Arouse competition among the pupils to see how many flashes are necessary for the recognition of the phrase. Small cards can be held close to the group. Larger cards containing phrases cut from advertisements, hand-bills, etc., may be flashed upon a larger group at a greater distance

Words written on the black board and covered may be uncovered for a fraction of a second.

VI. *Training in accuracy of interpretation*

1. Reading carefully, emphasizing the elements upon which meaning depends; *e.g.*, topic sentence, relational words, and effect of different phrases and clauses. This is to be oral, with questions and instruction by the teacher.

2. Reading competitively in silence to answer definite questions or to tell everything in the passage. Searching for essential points in any subject.

3. Making the phrase the unit of meaning.

a. Have group pick out the meaningful phrases in matter under discussion. Have matter read properly, showing the grouping of the words in the phrase by means of the voice.

b. In oral reading have pupil look ahead to be sure he can read through the next meaningful group of words before uttering them.

4. Building a background of meaning. An intensive study of word and phrase; of prefixes, suffixes, roots, synonyms, and equivalent idiomatic phrases. This is somewhat the same method as that described under II, but the emphasis here is upon meaning rather than recognition.

These methods will not all be used perhaps with any group, nor with every individual in the group. The method, or methods to be used must be chosen by the teacher with reference to the needs of the group, and only the teacher who works with them daily is capable of choosing. Perhaps the methods most used will be numbers 1 and 2, with number 2 the most common. Some individuals, however, will need the prescriptions of numbers 3 and 4.

VII. *Silent speed and quick interpretation drills*

1. Short selections to be read in a given time, or read competitively to see how soon they can be finished. These should be timed to the second, and the rates of the different pupils made known. Questions must be asked or reproduction demanded to insure thought concentration. This should sometimes be written, sometimes oral.

2. Longer selections to be read rapidly for the story or to find a certain number of interesting facts.

VIII. *Type of material*

All the exercises preceding require interesting material well within the comprehension of the pupils. This may be found in the grade readers, supplementary readers, readers of a lower grade, geography readers, histories, easy hygiene, or children's story books. Whatever is used, it must be carefully selected beforehand. To depend upon the inspiration of the moment to choose the practice matter will seriously endanger the success of the work. The selection of the material is one of the most difficult and artistic phases of the teacher's remedial efforts.

In the training for comprehension a somewhat more difficult material, though no less interesting, may be used.

IX. *Outside reading*

The pupil who reads only his school books will never learn to read. The more home reading the group does, either for pure pleasure or under the stimulus of ambition to learn to read, the more bountifully will your efforts at training be rewarded. Do everything possible to induce home reading. A *room library* made up of the books owned by individual pupils, a group library, a book loaned by some other pupil, or selected out of the school library — these together with interesting short stories may help.

X. *Fathers and mothers*

The teacher should tell the parents what she is trying to do for the pupil. They will appreciate it, and with a little advice on her part may help. Many will be glad to buy suitable reading matter.

She should find out whether the parents read to the pupil. If they do, she should insist that such a practice be stopped and show them the damage they are doing their child.

Accompanying this description of the remedial work, a list of her pupils was furnished each teacher with the type of training which should be given each. The training suggested for each child was determined by the process of diagnosis used by these authors. The various teachers were given only very general directions for carrying out the work. Some teachers arranged their classes in groups and gave the necessary training to each group. Others modified their entire plan of teaching so that every child in the class was given more or less of the remedial work. The training resulted in very large increases in the efficiency of certain children and in very small increases in that of others. If averages are taken as a measure of attainments for both the practice group and for groups not given the training, the results indicate that the special training is more effective than is the usual training given by these teachers.

The effects of the various types of training as set forth in the preceding discussions cannot fail to convince teachers that such work is highly desirable. It should be understood that the necessity for such training grows out of individual differences in the ability to acquire the highly complex habits involved in the reading process. As a result, the regular work of the school, which usually gives the same amount of training to all pupils, is not ample to develop all factors involved in the reading process to a degree which makes for efficiency in the reading of all children. For this reason, individual remedial work should begin in the early years of the school. If this were done, the necessity for it would in a large measure be eliminated in the upper grades. Such a procedure would cause the teacher to consider the remedial work as a regular part of her daily program. It would be better still if the teacher did not think of such measures as remedial, but as variations which should be made in general methods to care for individual needs. Another important point is that remedial work cannot be reduced to mere routine. The success of such work depends in a large measure upon the energy and ingenuity of the teacher. Every case has its individual variations and demands variations in the methods used.

CHAPTER XXII

VARIATIONS IN METHODS TO MEET THE NEEDS REVEALED BY DIAGNOSIS

This chapter has for its purpose a more detailed discussion the various remedial measures. These measures divide them-lves into those which are general in nature and those which e individual in nature. The discussion will be devoted first the general measures.

General Remedial Measures

A general method is one which seeks to place the attain-ents of all children in a class or school system on a higher ane. This type of method is of interest at this time, because e higher the average of the class the less the occasion for diag-sis and remedies. Two problems will be discussed in this nnection. One of these is concerned with the desirability of aking children conscious of the processes which enter into their ading habits, and the other has to do with differences between al and silent reading.

aking Children Conscious of Their Reading Habits

As reading is usually taught, very little is done to make ldren conscious of the activities which enter into their read- process. To them, reading has no interest except as they get aning by it. The process itself is entirely unknown to them. ne teachers have found, however, that children may become y much interested in the various phases of the reading process l that such an interest may be made a direct means of in-asing their efficiency. It is very easy to get children to under-nd the significance of the span of perception or of any other element involved in reading. Definite methods for increasing the efficiency of children in these various respects can be given and the pupils encouraged to observe the breathing coördinations, the eye-movements, or the amount of vocalization in the reading of other children. This general plan was followed by Miss Zirbes in her diagnostic and remedial work, and it is probably one of the elements which made for its success.

DIFFERENCES BETWEEN ORAL AND SILENT READING

These differences will be discussed from three different standpoints, as follows: (1) differences in the aims; (2) differences in methods; (3) differences in reading materials.

DIFFERENCES IN AIMS

The necessity for a clear understanding of the aims of these two types of reading is due, first, to the fact that there are fundamental psychological differences existing between them, and, second, to the fact that there is in the schools at the present time a decided tendency to decrease the amount of oral reading and substitute for it silent reading.

The aims of oral and silent reading vary with the stages or periods of development in the school life of the child. The school recognizes three distinct stages in the development of reading ability. The first of these periods is the time during which the child gets the form or mechanics of reading. The second stage allows the habits initiated in the primary period to be perfected. In the third stage the child should be trained in applying his silent reading training to different kinds of school work, and his oral reading work should be extended to include the finer elements of interpretation. In other words, the aims of oral reading should be different from the aims of silent reading, because the two types of reading are fundamentally different in the mental processes involved, and because, if clear cut aims and purposes *are not* set forth for each of these types, one or the other must suffer on account of the small amount of emphasis placed upon it. In the past, silent reading has not received due emphasis because its value was not clearly seen by teachers, while at present it seems that oral reading is to have too little time devoted to it because its fundamental aims and purposes are not appreciated.

Reading in the Primary Grades. This period takes up the first two years of the school life and in many cases a part or all of the third year. The purpose of oral reading during this time is to teach the mechanics of this subject. The mechanics of reading deals with most of the factors which have already been discussed. It involves those habits which are necessary for rapid interpretation, for the analysis of words, and for the establishment of a visual vocabulary. In addition to this, the beginning of habits required in the perception of words and in the motor processes must be partially established. It is also necessary that certain laws which have to do with the hygiene of reading should be learned. The main problem is to initiate these various habits at this time rather than to attempt to perfect them.

During the primary period the child has little need for silent reading. He is not yet able to comprehend any faster than he can read orally. The only reason for requiring silent reading at this time is that it is more convenient for the school and that in this way the form or mechanics of such reading may be acquired. The early development of silent reading is little understood. It is clear, however, that such reading is silent only in that the vowel sounds are absent. It involves all the motor coördinations of oral reading except the movements of the vocal cords. Gradually the vocalization movements and the breathing coördinations as required in oral reading are eliminated. It must also be true that the span of perception is gradually lengthened and the eye-movements adjusted to it.

Arguments are sometimes made to the effect that all reading in the primary grades should be silent. There are, however, several good reasons why oral reading should prevail during the primary period. First, it is exceedingly doubtful if the analysis of words can be taught in the beginning except orally. It is a matter of dealing with sounds as sounds. It is true that later the process becomes mental, but this is because the pupil has had an earlier oral experience with the sounds. A second reason for oral training in primary reading is that it employs a method with which the pupil is already familiar. Every child uses and is familiar with oral language, and oral reading is closely related to this. A third reason lies in the fact that methods of checking oral reading are much more simple and more easily employed than are the methods for checking silent reading. Checks in silent reading involve questions, reproductions, etc. These methods depend upon language ability in a considerable degree and are therefore difficult to use in the early stages of reading. A fourth reason for the oral procedure is that it seems better not to begin silent reading until the child feels a need for it. This need comes when his powers of recognition and interpretation exceed his rate of vocalization. A great deal of emphasis has been put upon the fact that silent reading is either not taught or very much delayed, but little has been said about forcing the child into it before he has any real need for it. It is not intended to argue that all primary reading should be oral, but it seems clear that it should be essentially oral.

Reading in the Intermediate Grades. The reading instruction of this period should have for its purpose the development and stabilizing of the habits which were initiated during the primary period. So far as silent reading is concerned, all vocalization and extraneous movements should be eliminated unless there is some individual reason for their presence. The span of perception should be well developed, and the eye-movements should become relatively small in number. At the end of the fifth year the child should be able to deal with any material within his mental grasp in a rapid and accurate manner. This is accomplished by having the child read a large amount of interesting material both in school and out of school. Parents who read much to their children at this time probably do them great harm, because the child must at some time learn to read for himself, and this is probably a better time for the formation of the reading habit than any other.

During this period the school should not only encourage the child to read but should also supervise the material read. In addition to these functions, there is at least one more which the school should perform. This has to do with checks. If left to himself, the child may develop careless and inaccurate habits of reading. The teacher should see that the child is held responsible for a certain amount of material which he reads, so that careless habits will not be established.

The oral reading of this period should perfect the habits which are at the basis of this type of reading and which have been only partially established in the primary period. All motor coördinations should be carefully looked after, accuracy in dealing with all types of language forms should be stressed, some elements of quality should be taught, and an appreciation of the demands of his hearers should be developed on the part of the child.

It is much more difficult to set forth rules of procedure for this period than for the preceding one. In general, it seems correct to say that a large amount of effort should go into silent reading. During this period, the various types of readers will be clearly differentiated. The excellent reader will stand out prominently both as to silent and oral reading. In the same way the poor reader's difficulties make it more and more difficult for him to progress, and finally he will stand out just as prominently as the excellent reader but in an opposite respect. The slow reader will find it impossible to make as rapid progress as others, and the inefficient rapid reader will find many opportunities to evidence the results of his inaccurate methods. Other children will develop into excellent oral readers but poor silent readers, and vice versa. Good teaching requires that the teacher be able to recognize these types in the early stages of their development. This means that just as a large amount of individual work is required in the primary grades to establish firmly the mechanics of reading, so there must be individual work at this time to perfect those habits which are necessary in both oral and silent reading.

Reading in the Grammar Grades. If facility in the reading habit is gained in the preceding period, the child is ready in the last part of the sixth year to enter upon the third stage in the development of his reading ability. During this period he is to be taught specialized types of silent reading. In his early instruction in reading, the child is interested in selections from the standpoint of the story or from the standpoint of questions to be asked concerning the passages. In this third period of training, the child needs to broaden his experience and to begin to read in anticipation of needs that will later arise in his school work. By this is meant that different school subjects require different types of reading, and the success of a pupil in any subject depends in part upon his ability to do the specialized type of reading required by that subject. The following are a few of the purposes which may actuate a pupil under circumstances of this kind:

1. To find what is required in a certain situation
2. To find the arguments made for and against a certain point
3. To outline the discussion given upon a certain topic
4. To translate a problem from language into symbols
5. To summarize discussion
6. To skim over material in order to locate a particular topic

That the elementary school does not measure up to its full responsibility in teaching these specialized types of reading is shown by certain criticisms which are made by high school teachers concerning the lack of such work in the elementary schools. To illustrate, high school teachers of history often say that their pupils cannot read historical material in an intelligent manner; or mathematics teachers say that their pupils cannot ead the problems with which they must deal. The implication of such criticisms is that the ability to do these types of reading should have been developed in the elementary school. While it is true that the high school must share in the responsibility for the development of these special forms of reading, yet it goes without saying that careful and painstaking work of this sort should be done in the latter part of the elementary school period. Any elementary school which sends its pupils to high school without some training in the special types of reading required in history, geography, mathematics, etc., has failed to a considerable extent in training its pupils. It should be realized by teachers of special subjects that their teaching problems are to a certain extent reading problems, and to this extent they must share the responsibility with the regular reading teacher. Some work in determining the nature of such specialized types of reading has been done by Pressey and Pressey (23) and Greene (18). The first of these authors emphasizes that the nature of silent reading depends very greatly upon its purpose or aim. Greene has shown the inability of students to get the meaning from specialized types of material.

Considerable progress is being made in working out in detail the aims for silent reading. In his constructive program for silent reading Horn (18) has emphasized five points as follows: (1) comprehension, (2) speed, (3) organization, (4) remembering, and (5) use of indexes, tables of contents, etc. O'Hern (21) has developed a chart of attainments in silent reading. This is worked out under four general heads as follows: (1) permanent interest in reading, (2) economical and effective study habits (3) economical and effective use of books, (4) thorough mastery of the mechanics of reading. Definite suggestions for carrying out each of these points in each of the school grades are given. This is one of the most helpful pieces of work which has appeared. Hawley (10) has shown the effects of clear objectives upon the reading of a number of children who had difficulty with their reading.

Smith (24) and Lyman (17) have emphasized the value of silent reading in high school work. The first of these authors sets forth four types of reading which the high school pupil is called upon to do. These are as follows: (1) problem solving reading, (2) reading for the central idea, (3) reading for information, and (4) reading of the narrative type. Lyman stresses the fact that students often get the idea that reading is a thing which may be done in an easy-going fashion. Reading, according to this author, should be taken seriously and should involve a large amount of mental effort. The implications of this article are far-reaching. If the reading of the American child is done upon a low level of mental effort fundamental changes in method should be made to meet such conditions. Data which bear out the statement of Lyman are to be found in a considerable number of investigations in which rate of reading has been very greatly increased by different types of training. Chief among these is O'Brien's (20) work. The results of this investigation show that his subjects were able to read efficiently at a much greater rate than they were accustomed to use. Such results seem to bear out Lyman's statement that children do their reading upon a low level of mental effort, because if the present method of teaching reading were correct, it ought not be possible to bring about large increases in rate by a relatively small amount of practice as O'Brien succeeded in doing.

The problem involved here is a fundamental one, the solution of which will require that much more be known about the highest level at which efficient reading can be done, about the methods for attaining such a level, and about those elements in training which make for the establishment of reading upon too low a level of mental activity.

It is sometimes argued that oral reading could be omitted from the curriculum during this period and that all reading done in the school at this time might be silent. It is the purpose of the discussion at this point to show that oral reading has aims which are distinct from those of silent reading and which are of suffiient importance to give it a definite place in the curriculum for he upper grades of the elementary school. In stating these aims t may be well to give first a few negative purposes concerning the oral reading of this period. Evidently it is not the purpose of oral reading at this time to teach dramatics or elocution or expression or public speaking. These may be legitimate at a later stage, but there is little or no place in the elementary school period for such training, except for a very small number of specially gifted children to whom such instruction can be given privately. To make the upper grades of the elementary school a place where this highly technical training is given is probably to miss entirely the point for such training.

The discussions of various authors will now be referred to as a means of obtaining positive suggestions as to the aims for oral reading in the upper grades. Many authors content themselves with very general distinctions between oral and silent reading. To illustrate, Summers (25) says:

> Oral reading is the process of interpreting thought from the printed page and imparting it to another by means of the voice.

Another statement of the same kind is by Farnham (6). This author says:

> Reading consists first, in gaining the thoughts of an author from written or printed language, second, in giving oral expression to these thoughts in the language of the author, so that the same thoughts are conveyed to the hearer.

Many other similar definitions or statements could be given. Such general statements are practically worthless to the teacher. Such definitions of oral reading are broad enough to include all ral reading from that of the primary child to that of the most xperienced actor. For this reason, such definitions have little r no value for one who is attempting to teach oral reading in any articular school grade.

Other authors give much more definite suggestions upon the roblem at hand. Turner (28) emphasizes six different problems or upper *grade oral reading.* These are as follows: (1) certain language values, such as grouping, connectives, etc., (2) cultivation of the imagination, (3) interpreting the spirit of a selection, (4) pauses, (5) continuous thinking, and (6) articulation.

In their discussion of intermediate and grammar grade oral reading, Briggs and Coffman (3) emphasize position, articulation and enunciation. In their chapter on articulation and enunciation they discuss breathing and voice.

Clark (5) gives four criteria for vocal expression. These are time, pitch, quality, and force. In his discussion of methods of instruction he emphasizes the mental attitude of the reader, language relations, emotions, and atmosphere. The various discussions throughout the book are for the benefit of the teacher, so that she may have adequate standards for reading. The plea of the book seems to be first for careful, systematic silent reading. If such reading is insisted upon oral reading will, according to this author, take care of itself. The theory of Clark seems to be that impression must be a matter of instruction, but that expression requires no special training.

Jenkins (12) makes the following suggestions concerning the results to be obtained in primary reading, and it seems that they may well be considered in upper grade reading:

> A flexible voice, trained until habits of modulation have become automatic in ordinary reading, should be the aim. When the thought is understood and the form mastered, the voice naturally falls into a rhythm and melody of expression, largely due to the rhythmic movement of the eyes and the rhythm of breathing. The more essential parts are emphasized according to the ability of the reader, and the result gives pleasure.
>
> Ready recognition of the more important parts and the ability to render them skillfully will come only after much careful teaching has brought these parts into consciousness and given opportunity for their use. To dwell upon the loud and the soft, the swift and the slow, the joyous and the sad, as expressed in specific sentences, brings these elements into the focus of consciousness and assures steady advance in artistic expression.

The suggestions of Klapper (14) upon this topic are as follows:

> Despite the inestimable advantages of silent reading, oral reading must occupy a coördinate position with it in class teaching for many reasons:

(a) the teacher must test the child's knowledge of the symbols. In rapid, silent thought reading the child gives no evidence of what symbols he does not know. (b) Oral reading is a test of the thought acquired. By the voice and intonation the teacher knows that the child has the author's idea. (c) Clearness and accuracy of articulation and enunciation and correct use of voice are desiderata in all oral speech. It is in oral reading that the child's limitations in these speech elements are noted and appropriate drills planned for the following phonic lessons. (d) Words and phrases have their own worth. They add to every pupil's expressional and interpretational vocabulary. In silent reading words and phrases may be lost in the search for the underlying thought; in the oral reading words and expressions are given almost equal rank with silent reading in school. The dignity, the force, the cadence and the music in literary language can better be felt in oral than in silent reading.

Some of the most helpful suggestions are to be found in Carson's (4) little book on the voice. One quotation may be given, as follows:

> Reading, I have said, is not acting. It is the acting which usually accompanies the reading or recitation of the professional elocutionist which cultivated people especially dislike. When they wish to see acting, they want serious interpretative vocalization; only that and nothing more is necessary, unless it be a spontaneous and graceful movement of the hands, occasionally, such as one makes in animated conversation.
>
> Again, the most elegant way of vocally interpreting a poem, is to read it from a book, rather than to recite it. Recitation has much to do with this acting business. In fact, elocutionists recite in order to have their arms free to act — to illustrate the thought they are expressing. Thought should not be helped out by gesture. Gesture results, or should result, from emotion, and should, therefore, be indefinite.

Bobbit (2) gives three fundamental reasons for oral reading, as follows: (1) in a democracy there should be the ability among the citizens to express thought to an audience; (2) there is a reflex action of oral reading upon the reader himself which is important; (3) oral reading has importance in the primary grades because it gives an experience with language which cannot be obtained in silent reading.

This brief survey of the literature upon the purposes of oral reading seems to indicate three rather distinct aims for grammar-grade oral reading. First, there are those phases of oral reading which are distinctly physical and objective in their nature; second, oral reading gives an appreciation of language which it is difficult to get in any other way; and third, oral reading involves a type of interpretation which is not required by silent reading. These aims seem to be of sufficient importance to give oral reading a definite place in the curriculum during the grammar grade period. The first two aims have been discussed at some length in the quotations just cited and will not be treated further. The last point will be taken up for a more detailed discussion in the paragraph which follows.

Interpretation Required by Oral Reading in the Grammar Grades. In beginning this discussion it may be well to compare interpretation in silent reading and interpretation which is required by oral reading. In silent reading the interpretation is rapid, and therefore it is somewhat gross in its nature. It cannot involve fine shades of meaning and details. It first seeks the larger elements of the thought, and if details are required a second or third reading is necessary. In contrast with this, the interpretation involved in oral reading is always detailed. It requires an appreciation of shades of meaning and of the feelings for language relations. To read orally necessitates that the reader be able to evaluate in a careful manner different words, phrases, and other language units. It is not sufficient to talk of these in a perfunctory or formal manner. These relations must be felt. They must be one's own. In other words, the purpose of oral reading in the grammar grades, from the standpoint of interpretation, is to teach a more comprehensive and detailed type of interpretation than is required in silent reading. Oral reading of this type will always follow a careful study of a selection. Oral reading will grow out of a fullness of understanding and a desire to express to someone else what is known. The type of interpretation sought here is subtle in nature and is to a large extent in the realm of feeling. For this reason, the grosser *checks* of silent reading do not suffice in this case. These detailed meanings can only be revealed by such elements as emphasis, force, pitch, etc. This type of interpretation will be enhanced by having the children listen to good reading. Such reading may be done by the teacher or by the best readers in the school. These children may often be selected from other grades than that in which the recitation is being conducted.

The importance of training in these finer elements of interpretation cannot be overemphasized. Its immediate results are better methods of expression and better appreciation of meaning. If proper methods are used, such training can be made to function both in oral and written composition work and in methods of study. A criticism of the work of children which is heard probably more often than any other is that they are satisfied with half meanings, or that they do not pursue their work in a detailed and accurate way. The type of work under consideration will doubtless do as much as any other phase of school work to counteract such tendencies on the part of pupils. Other points of a similar nature might be made in regard to oral reading in the upper grades, but the foregoing is probably sufficient to show that any curriculum which eliminates oral reading from the grammar grades takes from both the teacher and the pupil an important means for developing some of the most fundamental phases of language ability.

DIFFERENCES IN METHODS

Checks. Any reading work, to be effective, must include certain checks upon the work of the pupil. This seems to be one of the chief difficulties confronting the teacher of silent reading at the present time. Motives for silent reading have already been given. The point at hand is concerned with whether or not the children are able to conform to such motives. One check which is often used is written work. The child may reproduce the selection in writing, or he may answer a series of questions in writing. This gives the recitation the character of an examination and leaves the teacher with a body of material to be examined outside of school hours. If such technique is to be effective, all mistakes and errors should be carefully analyzed, and suggestions should be given which show the child how to obviate the same errors at another time. This means that the work must go beyond the mere reproduction or answering of questions. It must train in the technique of silent reading.

Another check which may be used is to have the children respond orally. This means an oral reproduction, an oral answer to a question, or an oral outline. This relieves the teacher of any later work, and allows the giving of general instruction by the teacher. Again the fundamental purpose here is training in silent reading and not merely the answering of questions or reproduction.

In oral reading an entirely different type of check must be used. Such reading may be evaluated as to its accuracy by noting the words mispronounced. This method of checking the child's reading many times involves much waste of time. A child is corrected for a certain error to-day, and to-morrow he makes the same type of mistake. It seems that it would be better to neglect many of the small errors which children make during their oral reading. If the child has a real problem and is interested in it and is working at it, it makes little difference if he says "a" for "the," or if he makes other minor errors. The main thing is for the reading to proceed in such a manner that those who are listening will get the thought. To be sure, all gross errors should be corrected; and if a child has a habit of repeating one type of error, such should be carefully studied by the teacher and proper remedies applied.

Oral reading may also be checked as to interpretation by means of the emphasis, force, pitch of voice, and other elements of technique which the child uses in his reading. The efficient use of checks of this type is a difficult phase of methods and presents problems to the most skillful teachers.

Other Phases of Method. Typical lessons in silent reading have been reported by Heller and Courtis (18) and by Stone (26).

In this same connection Yoakum (18) has shown the results of a single reading and Germane (18) has compared outlining and summarizing with rereading as methods of study.

MATERIALS FOR READING

One of the vital factors in developing reading ability is the amount of reading done. Very often the excellent reader is one who reads a great deal, whereas the poor reader is one who reads but little. The opposite of this statement is also true in many cases. That is, the pupil who reads but little is a good reader, and the one who reads a great deal is a poor reader. In other words, reading is a habit which must be developed by practice. The realization of this fact has led in most schools to the supplementing of the reading material found in the child's text. At the present time no school is considered well equipped which does not have more or less supplementary material. In many instances, the supplementary texts furnish selections which are very similar to that in the basic text. Indeed, there seems to be no reason why the usual form of text-book should be employed in preference to the supplementary texts because the basic texts furnish only material which is to be found in most of the supplementary books. In other words, the basic text serves very few, if any, purposes different from those of the supplementary texts. However, if texts were supplied for the various grades which brought together material so selected as to be well adapted for the development of a certain technique of reading, then there would be a real need for them. To illustrate, a teacher may be confronted with the problem of developing in certain pupils the ability to read silently, for any one of the many purposes enumerated on a preceding page. To develop any one of these aims requires a body of well-selected material. If a text supplied such material, it would be a very great aid to the teacher. Texts as they are often written do not do this. They supply only material for more extensive reading and not for intensive reading of a particular type. The usual form of texts should be read as any other book. It seems desirable, then, that the child should have access almost from the first of his training period in reading to a number of well selected books which furnish him with reading material in which he is interested and which is expressed in a form which makes it possible for him to read it.

The development of the technique of silent reading requires many different types of material. If the aim is rapid silent reading, the selection should be within the grasp of the children; but if the aim is accurate interpretation, the material should be relatively difficult. For other purposes, it may be desirable to use the narrative form of prose, and for still other purposes scientific prose may be the proper form of material.

Still another factor which must be taken into consideration in the selection of material for teaching silent reading is the check which is to be used. If reproduction is to be used, material which can be reproduced with not too great difficulty should be selected. On the other hand, if some other type of check is to be used, material should be selected which is adapted to the particular form of check which is to be employed.

Without doubt one of the difficulties which confronts teachers who are attempting to teach silent reading is the lack of a body of well-selected material. To buy a set of supplementary readers may be wasteful, because much of the material in such readers would probably not lend itself to any definite problem which may be before the teacher. From this standpoint a step in advance is marked by the fact that bodies of material for silent reading are appearing in the form of a series of texts.

The problem of selecting material for oral reading is almost as difficult as in the case of silent reading. Here again it is a problem of procuring material which is adapted to a particular problem. Some teachers make the mistake of using all selections which are studied silently as exercises in oral reading. Such a procedure is based upon the assumption that the same selection is always adapted to both oral and silent reading. Such an assumption may be questioned. Many selections may be excellent material for silent reading, but at the same time have very little value for oral reading, and *vice versa.*

In making selections for oral reading the interest of the hearer should be considered. In many instances no one in the class should be familiar with the selection to be read except the pupil who does the reading. Under these conditions the child who reads should receive his instruction and training in reading the selection individually, and the recitation should show the result of such instructions. On other occasions, when it is the purpose of the teacher to give definite instructions in oral reading, a text should be provided. A second requirement of material for oral reading is that it should be within the grasp of the reader. Oral reading represents the effort of the reader to give out something. It represents the reader's contribution for the pleasure and instruction of the listener. In this case the material read must be virtually the reader's own. He must know it, understand it, and feel it. In no other case can oral reading be successful. A third requirement is that the selection be worth while to the reader. He should be interested in it and really desire to convey it to the hearer. As a fourth requirement it may be pointed out that at least a part of the oral selections should be of such a type that their best interpretation comes through an oral presentation. If these various requirements are considered, it is clear that no compilation of selections has been made which fulfills all these conditions. An ideal provision would probably include a text for the class and a considerable number of books for individual work. Other phases of reading material have been studied by Starch (18), Packer (18), and Stone (27).

INDIVIDUAL REMEDIAL MEASURES

Preceding discussion has served to point out certain processes which seem to be essential to efficient reading. The process of diagnosis has shown that difficulties in reading are many times due to either underdevelopment or overdevelopment of certain of these processes. In most cases the difficulties resulting from such conditions are individual matters. Remedial measures of the individual type are used in dealing with single pupils or with pupils in very small groups, so that needs of the individual child may be cared for. Individual measures divide themselves into those which are indirect in their procedure and those which are direct in their methods. A direct method seeks to bring about results by giving training which would result in an increase or a decrease in one or more factors which are involved in reading ability. For example, if it is found that a slow reader has a span of perception which is underdeveloped, training to increase this might be designated as a direct measure. On the other hand, if in the same case a large amount of reading was required of the reader, this would be an indirect method of attack. In general it may be said that the indirect methods intensify the usual methods of instruction.

Direct Methods

In this part of the discussion training which is concerned with the various processes which enter into reading ability will be treated.

Span of Perception. Practice of this kind, to be effective, should come early in the school experience of the child. Such drill can be given individually or to small groups. In conducting this type of work the flash-card plan has most often been used. This has the difficulty of having no adequate control of the time. If such work is to be effective, this element should be carefully controlled. For individual work the apparatus shown on page 309 can be used to advantage. The material for this form of apparatus is easily prepared by means of a typewriter. The best type of apparatus for group instruction is a stereopticon lantern the lens of which is mounted in a photographic shutter. The best shutter for this purpose is called the Ilex Shutter. This may be had from Burke & James, Chicago. If the lens with which the lantern is fitted is sent to this firm, they will mount the lens in the shutter. The expense of the lantern and the mount-ing of the lens is not excessive. By means of this shutter the time of exposure can be varied as the material or the children who are being trained may require. The material should be selected as is done for the flash-card work and made into the form of lantern slides. Such slides can usually be made at a local photographer's. If training of this type is given under these conditions with young children, it will prove much more effective than the usual work with flash cards.

Qualitative Phases of Perception. This type of ability is fundamental to an analytical knowledge of words. It is based upon both practice and knowledge. This kind of work is usually called for in phonics. It is true that the emphasis in teaching phonics is usually placed upon sounds, and that the form of words is emphasized only as a means of making clear the auditory elements of language. It is altogether probable that more emphasis should be placed upon the form of words. In such work differences in letters, syllables, and words should be emphasized.

Motor Phases of Reading

Reducing the Amount of Vocalization in Silent Reading

Types of Children. When teachers attempt to decrease this element in the silent reading of their pupils, they should remember that there are apparently two types of children with respect to this phase of reading. For one of these types the vocalization is a habit carried over from the early experiences of the child, while in the other case it may be a fundamental element in reading. Strictly speaking, the reduction of vocalization should not be undertaken unless the child belongs in the former class. Such a distinction between the two types often is difficult to make. If the child is decidedly motor in other activities, it may be expected that he will be motor in his reading. If, on the other hand, a child is not motor, but employs much vocalization in his reading, it is fairly safe to conclude that the vocalization is a habit and that corrective measures may be applied.

Rate of Reduction. Still another problem in this connection is the rate at which such reduction should be made. The best method of procedure is for the teacher to discuss the problem with the child and so enlist his coöperation. Frequent tests might be used to determine the effect of the practice. It is highly desirable that the reading of each child be watched, and if it is seen that efficiency in comprehension is decreasing, it would certainly be desirable to discontinue the practice.

RATE OF VOCALIZATION

Two elements enter into this phase of reading ability. These are muscular reaction and familiarity with language forms. It is doubtful if the first factor is affected by practice except in a small degree. There are certain pupils who seem to react slowly in every way. Speed drills in which comprehension is not emphasized should be used. In such drill, the child may be required to read rapidly regardless of the results. In some cases children seem never to have experienced the sensations which accompany rapid reading. After these are once experienced, there is some tendency left to return to them. The second element will be discussed under another head.

EYE-MOVEMENTS

It should be remembered that the movements of the eyes are of such a nature that there is very little to guide the reader in making them. If the eye is focused on the first word of a line, there are no objective cues or signs which direct it to its next stopping place. Furthermore, if the eye is at the end of a line, there is nothing of an objective nature to guide it in its movement to the beginning of the next line. Attention has also been called to the part which rhythm plays in the movements of the eyes. Again, there is nothing of an objective nature which determines the rhythm. There seems to be no reason why an element which is as important as eye-movements in reading should not be called to the attention of all children. They should first be told about it, and then be allowed to observe these movements in the reading of other children by means of a mirror. This could be followed by suggestions that they make an effort to reduce the number of their movements as much as possible. If this method of training fails, another plan may be tried. In such cases material should be prepared as shown below. The dots above each line indicate the letter where the

. . . . . .

At last Tim began to feel tired; he hurt his foot with a

. . . . .

sharp stump. A fat yellow frog jumped up in his face

. . . .

and so startled him that he nearly fell backwards into

. . . . .

the water. He was frightened, and had culled more

. . . .

kingcups than he could carry. So he scrambled out, and

. . . . . .

climbed the bank, and cleaned himself up as well as he

. . . .

could with a small cotton pocket handkerchief, and thought

. . .

he would go on to school.

eyes should be focused, and the alternate indentation at the left will help in guiding the eye in its sweep from right to left. Such material may be read while the teacher observes the reading by means of a mirror. Such a procedure should give a check upon the success of the child in carrying out the directions. The child should be allowed to repeat the reading of the passage until the proper movements are established for that selection.

EXTRANEOUS MOVEMENTS

In those cases where such movements indicate a general lack of adjustment to the reading situation, there is usually a decided decrease in such reactions when the reading improves. This means that one method of dealing with such a situation is to let it alone, and effect improvement by increasing efficiency in other phases of the reading process. A second method is to discuss the matter with the child, pointing out that an improvement in his reading could be brought about by the elimination of such movements. Children for whom the extraneous movements constitute a habit will be able to reduce such movements by a little extra effort. In others the difficulty may be much more deeply seated, and more time and effort will be necessary to get results.

BREATHING

Types of Breathing. There are three types of breathing, the high chest, the dorsal, and the diaphragmatic. In the first type only the upper part of the lungs is brought into use. This form is usually sharply criticized by instructors. The second type is produced almost entirely by the raising and lowering of the ribs, while the third is produced by the raising and lowering of the diaphragm. Most authors agree that the best form of breath control results from a combination of the last two types. Exercises in which the children are required to place their hand on different parts of the thoracic region in order to feel the different movements are of very great help in teaching correct breathing.

Conservation of Breath. A second important point in regard to breathing is the conservation of the breath. It has already been pointed out that in the breathing curves the inspiration is shorter and the expiration period is longer than in ordinary breathing. All oral reading should begin by filling the lungs with air. This is easily done, but the conservation of it so that the reading may continue is the difficult part of the procedure.

Some children will expel nearly all their breath with the first syllable and then gasp for more. Reading of this type is accompanied by a series of gasps. There are other children who succeed better than those indicated above, but their reading sounds as if they had "run down" when they get near the end of a sentence. Children who have difficulty with their breathing coördinations need practice in reading passages with points for breathing marked, as shown below. The child should be required to take in breath at the beginning, and then is expected to read to the first mark without further inspiration.

"While they stood talking, | two immense serpents rose out of the sea | and made towards the camp. | Some of the people took flight, | others were transfixed with terror; | but all, | near and far, | watched this new omen. | Rearing their crests, | the serpents crossed the shore, | swift, | shining, | terrible as a risen flood | that descends upon a helpless town. | Straight through the crowd they swept, | and seized the priest Laocoön where he stood, | with his two sons, | and wrapped them all round and round in fearful coils. | There was no chance of escape. | Father and sons perished together; | and | when the monsters had devoured the three men, | into the sea they slipped again, | leaving no trace of the horror." |

When a point is reached, there should be a distinct pause and a full inspiration. In this manner the reading should continue until the passage is completed. In such training the breathing will necessarily be at first a conscious process, but as training proceeds it becomes habitual.

Breathing Pauses. A third phase of the breathing problem is the location of the breath pauses. It is generally understood that breath may be taken at a period, a colon, a semicolon, or a comma. In music it seems to be good form to breathe before a preposition, an adverb, a relative pronoun, and, when necessary for emphasis, before an adjective which comes after a noun. It will be seen immediately that this is closely related to phrasing. By phrasing is meant a grouping of the words which enter

EXTRANEOUS MOVEMENTS

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Quality of Oral Reading

The methods involved here have been well treated in Clark's (4) book as well as in others of like nature. A careful study of books of this type is recommended for those who are interested in such problems.

Remedial Measures for Different Types of Readers

It is now the purpose of the writer to consider remedial measures which may be used in dealing with the various types of readers.

Type I. The Efficient Reader

No remedial work is needed, but the teacher should see that such children have plenty of supplementary reading material. In many cases children of this type will be benefited little by the regular recitation work in reading. They may be allowed to spend this time in supplementary reading or in some other type of work.

Type II. The Inefficient Reader

The inefficiency of this class shows itself not alone in one phase of reading, but in most aspects of the process. In very few cases can pupils of this class be made efficient readers. Wherever possible they should be put in special classes and given intensive training.

Indirect Measures. Such children need to read more. They are the pupils for whom the regular time given to reading is not sufficient. Owing to the importance of reading, it seems that much extra time should be devoted to reading for this group. At first this supplementary work should be done in the school, but later the child should be encouraged to read at home. In many cases it will be necessary to enlist the coöperation of the parents, because reading for children of this type is a tedious and laborious process, and therefore not one which they enjoy.

Direct Measures. It will be found that most of the methods used in the early stages of reading need to be continued in the later reading of the pupils in this group. Perception work as previously described will be found very necessary. Every type of motor coördination should be carefully noted and measures adopted to increase efficiency. A great deal of attention should be given to the different phases of language ability required in reading, and an effort should be made to have the reading done at a high level of attention. In so far as possible the material read should fit into their experiences, so that the apperceptive factors may be effective.

TYPE III. THE SLOW READER

This is the pupil who comprehends what is read but who reads so little as to make the reading very inefficient.

Indirect Measures. The reading of supplementary exercises both in school and out should be emphasized. This should always be done at a high level of attention. Frequent speed drills should be given. The purpose of these is to give the child the sensations which go along with more rapid reading than he usually does. A check upon comprehension after these drills is important, because sometimes it is found that the child is able to comprehend as much in the speed drills as in ordinary reading.

Direct Measures. Short exposure exercises should be emphasized for the purpose of increasing the span of perception and giving a synthetic knowledge of language. A careful study of the motor phases of reading should be made to bring about the proper coördinations. In this connection eye-movements should receive special attention.

Language Relations. In the upper grades special work which emphasizes various language relations should be stressed. In many cases stress should be placed upon synonyms and upon expressions similar in meaning. With some children it may be necessary to give drill in phonics.

TYPE IV. RAPID READERS

This group includes those who read too rapidly for efficiency. The usual caution given these pupils is that they should be careful to understand what they read. This procedure is not always of the best, because the problem is to increase comprehension if possible without a decrease in rate. If a plan can be devised which will allow the usual rate and at the same time make for an increase in comprehension, such a method is preferable.

Indirect Measures. Encourage much reading. This should be done with material in which the pupil is interested and from which he is anxious to get the meaning. Another plan which seems to make for efficiency is to give these pupils a definite purpose or problem for their reading. It may be a matter of answering questions, of reproduction, of outlining, or of memorizing, or may be done for any other purpose which furnishes a definite end to the reading. There is entirely too much reading which has the form of reading but is lacking in any fundamental aim or purpose. It is entirely probable that this aimless sort of reading has much to do with producing reading habits of the type under consideration.

Direct Measures. In order to develop language ability, all forms of training which have to do with this phase of reading ability should be emphasized. This will include practice in analysis and synthesis, in language relations, and in meanings. It is probable that this type of training will most nearly overcome the difficulty.

TYPE V. EFFICIENT ORAL READERS, INEFFICIENT SILENT READERS

In this group there are those children who have not been able to differentiate in their reading between those methods which make for efficient oral reading and those which make for efficient silent reading.

[illegible] so [illegible]

Type III. The Slow Reader

This is the pupil who comprehends what is read b[illegible] reads so slowly as to make the reading very inefficient.

Corrective Measures. The reading of supplementary [illegible] in school and out should be emphasized. This should be done as a large part of assignment. Freque[illegible] drills should be given. The purpose of these is to give the experience which goes along with more rapid readin[illegible] [illegible]. A check upon comprehension after the[illegible] [illegible] because sometimes it is found that th[illegible] [illegible] of comprehension is [illegible] by the speed drills as [illegible] reading.

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APPENDIX A

In the pages which precede it has been necessary to introduce certain statistical terms. Instead of taking time for the consideration of these terms at the various places where they were used, it was thought advisable to confine discussions of this type to an appendix. The treatment will necessarily be brief and will be entirely in terms of reading.

METHODS OF ORGANIZING DATA

The methods by means of which certain problems in reading are dealt with involve results from large numbers of children. In order that data which are collected in this manner may be more easily interpreted, it is necessary for such results to be organized into some compact form. In other words, the scores made upon reading tests have little meaning as long as they appear as individual results. In order that they may be comprehended, they must be related to one another or they must be systematized. Two methods for organizing material of this type are most often used. These are tables and graphs.

Tables. A simple form of table was made use of on page [illegible]. In this table there are three parts. First, certain scores with respect to reading ability are listed in a definite order. Second, the various school grades are set down. Third, the number of pupils who made each score when the test was given is recorded. Other tables which have been used are much more complex than this one because they include many types of data rather than only three. The advantages of attempting to deal with scores in this form rather than as they appear on the test sheets are very apparent.

Graphs. Data of the type just discussed may also be organized in the form of a graph. One type of graph was used on page [illegible]. Such a curve sets forth certain scores with respect to comprehension, as indicated on the base line, and also shows the number of pupils who have made each score. This number is indicated by the height of the rectangular column. Such a method is preferable in that it indicates the number of subjects graphically. For many readers this is more impressive than the numerical values given in tables.

The form of graph which has just been referred to is usually spoken of as the distribution curve. If it has the form of the one shown on page [illegible], it is spoken of as a normal distribution curve. The theory of this curve involves some very intricate mathematics, and serves as a basis for much of the procedure in mental measurements.

MEASURES OF CENTRAL TENDENCY

After a number of scores or measures have been arranged in the form of a distribution curve, they can be dealt with further by determining the central tendency of the resulting graph. The determination of the central tendency for a distribution chart requires that there be found the score or measure about which all the scores or measures seem to cluster or group themselves. Three measures for such a clustering or grouping of scores are usually given. These are the median, the arithmetic mean, and the mode.

The Median. If the median is found for a distribution curve, that point on the scale above which and below which an equal number of measures occurs must be determined. A simple case in which the median is easily found may be seen in Diagram XI. In this diagram the hypothetical sc[illegible] extends from 1 to 11 and one person is assumed as making each score represented in the scale. In this case the median comes at six, because there are five persons who make a lower score than six and five who make a higher score than six. The problem would be a little less simple if the hypothetical number of persons had been an even number rather than an odd. To illustrate: If the number had been ten instead of eleven, the median score would not appear at any of the points indicated in the scale but might be considered as being at 5.5. In this case, it is clear that no person would make the exact median score. A method for dealing with a much more complex situation has been devised by Monroe as one phase of the scoring of his silent reading test. This is shown in Diagram XII.

DIAGRAM XI

Showing the Meaning of the Term Median

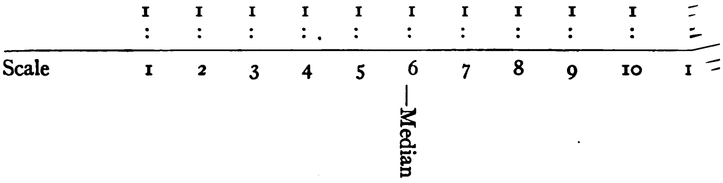


DIAGRAM XII

Showing Methods by which the Median Score may be obtained for the Monroe Silent Reading Test by Monroe

Rate Score		Comprehension Score	
Interval	Number of Pupils	Interval	Number of Pupils
Above 160	....		....
151 to 160	....		....
141 to 150	....		....
131 to 140	....		....
121 to 130	....	80 & above	....
116 to 120	....	70 to 79.9	....
111 to 115	....	60 to 69.9	....
106 to 110	....	50 to 59.9	....
101 to 105	....	45 to 49.9	....
96 to 100	....	40 to 44.9	....
91 to 95	....	35 to 39.9	....
86 to 90	....	30 to 34.9	....
81 to 85	....	27 to 29.9	....
76 to 80	....	24 to 26.9	....
71 to 75	....	21 to 23.9	....
66 to 70	....	18 to 20.9	....
61 to 65	....	15 to 17.9	....
56 to 60	....	13 to 14.9	....
51 to 55	....	11 to 12.9	....
46 to 50	....	9 to 10.9	....
41 to 45	....	7 to 8.9	....
36 to 40	....	5 to 6.9	....
31 to 35	....	4 to 4.9	....
26 to 30	....	3 to 3.9	....
21 to 25	....	2 to 2.9	....
16 to 20	....	1 to 1.9	....
Below 15	....	.0 to .9	....
Total		Total	
Median		Median	

Instructions for Making the Distribution of Pupils' Scores, and for Finding the Median Score.

1. The teacher must be careful that her papers are grouped correctly by classes. If she has but one grade of pupils, say 5th grade, or but two divisions of one grade, say 5th A and 5th B, then her papers are all grouped together and but one "distribution" made. If, however, she has parts of two or more grades, say part 5th and part 6th, she must make two or more piles of papers, one for each grade.

2. Arrange the children's papers for any class group in order of the comprehension scores, the lowest score on top.

3. To make the distribution called for, count the number of papers whose scores fall within the successive groups listed. For instance, if the lowest score is 3.5, the next lowest 5.7, the next 7.1, 7.8, 8.3, and so on, you will put "1" in the group marked "between 3 and 3.9"; "2" in the group marked "between 5 and 6.9," "3" in the group marked "between 7 and 8.9," and so on until the whole number of scores are recorded. The sum of these numbers must equal the number of children taking the test.

4. The median score is the score on the middle paper in the pile of papers arranged according to size of scores. If there are 35 papers, the median score is the score on the 18th paper. If there are 36 papers, the median score is half way between the score on the 18th paper and the score on the 19th paper.

5. Repeat 2, 3 and 4, for the rate scores.

The Arithmetic Mean. This term is often spoken of as the *average.* It may be defined as the sum of all the scores divided by the number of scores. A simple problem such as that seen in Table XXVI will illustrate this general statement. Twelve children made the scores listed in this table on the Monroe silent reading test. The method by which the average is found is very simple and needs no discussion.

TABLE XXVI

Showing One Type of Calculation which may be used in finding the Arithmetic Mean

Pupil	Score for rate
1	31
2	44
3	54
4	59
5	67
6	76
7	76
8	87
9	98
10	108
11	118
12	127
Sum	945
Average	945 ÷ 12 = 78.7

The Mode. After a number of scores are arranged in the form of a distribution curve, the mode is said to be that point on the scale which designates the score made by the greatest number of subjects. In Diagram X (page 105) the mode is at that point on the base line indicated by (2.1 — 3.0). In discussing Diagram VI Brown speaks of it as a curve with five modes.

It should be understood that the determination of any one of the three measures of central tendency often requires methods which are more involved and more refined than those set forth at this time.

MEASURES OF VARIABILITY

Only one measure of variability has been used in the discussions which precede. This is the average or mean variation. It *may* be defined as the average of the variations which a series of measures makes with respect to their average. This may be illustrated by a simple problem such as that seen in Table XXVII.

TABLE XXVII

Showing one type of Calculation which may be used in finding the Mean Variation

Pupil	Score	Variation from the Average
1	31	24.1
2	44	11.1
3	54	1.1
4	59	3.9
5	67	11.9
6	76	20.9
Average	55.1	Mean Variation 12.1

The column to the left indicates that the scores of six pupils for a silent reading test are being used. The middle column indicates the scores made upon this test by this group of pupils. The average of these scores is 55.1. In the column to the right the variation of each of the measures with respect to the average is given. The algebraic sign of these variations is not taken into consideration. The average of these variations is 12.1, which, according to the definition above, is the average or mean variation.

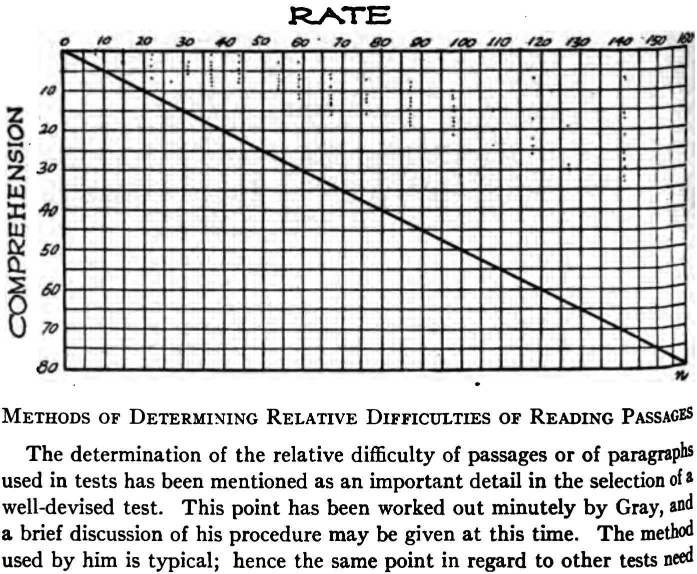
MEASURES OF RELATIONS

Another important element which enters into the treatment of data obtained by reading tests or experiments is the determination of the relations that exist between the various processes which enter into the reading activity. To illustrate: It is important to know the relation which exists between rate of reading and comprehension of reading, or between the span of perception and the rate of reading. The relation which exists between rate and comprehension, as indicated by the scores made upon the Monroe silent reading test, is shown graphically for ninety fourth grade children in Diagram XIII.

It will be noted that one of the axes represents the scores in rate and the other the scores in comprehension. Each dot represents a pupil. If there was a perfect relation between these two elements in the reading of this group of children, each dot would appear on the line *ON*. By a perfect relation is meant that a change in one factor is accompanied by a corresponding change in the other. Various formulae are available by means of which such relations as that noted above may be expressed numerically. Such formulae will be found in the references given at the end of the Appendix.

DIAGRAM XIII

Showing Relation between Rate of Reading and Comprehension in Reading



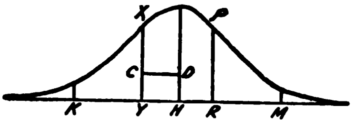
METHODS OF DETERMINING RELATIVE DIFFICULTIES OF READING PASSAGES

The determination of the relative difficulty of passages or of paragraphs used in tests has been mentioned as an important detail in the selection of a well-devised test. This point has been worked out minutely by Gray, and a brief discussion of his procedure may be given at this time. The method used by him is typical; hence the same point in regard to other tests need not be discussed. There are two methods which have been employed in the making of scales. These plans have been spoken of by Rugg and Clark in their work upon Algebra as the "teacher-judgment" method and the "proportion-of-pupil-solving" method, or, in the case of reading, the "proportion-of-pupil-reading" method. In devising a test for reading, the first method would require that a series of passages be submitted to judges who would pass upon their relative difficulty. Gray, who used this device in some preliminary work, concludes that unless a large number of very competent judges is employed the results are not reliable.

The second method requires that the different passages be read by a group of children and that the relative difficulty be determined by the results thus obtained. To understand Gray's method of dealing with this problem it is necessary to assume a series of passages to be read by a number of children. Let the number of children be two hundred. It may also be assumed hat these passages are sufficiently difficult, so that not all of this group of hildren will make a score of 100 on a scale which runs from 0 to 100, and hat no passage is so difficult but that it can be read by a small number of he pupils. To satisfy these conditions, let it be assumed further that three per cent failed to read the easy selection. Since the second paragraph is nore difficult than the first, ten per cent of the pupils may be assumed as failing to read it. It might also be true that a still more difficult paragraph would cause fifty per cent of the children to fail, and that the most difficult selection would be read by only three per cent of the group. Such facts are expressed in Diagram XIV.

Diagram XIV

Normal Distribution Curve



The area of this curve may be thought of as representing the two hundred subjects assumed in the beginning of the discussion. Then, if three per cent failed on the easy selection, and ninety-seven per cent read it successfully the position of this selection might be thought of as being at the point *K*, which is so located that three per cent of the area of the curve is to the left of it and ninety-seven per cent of the area is to the right. The point *H* is ocated at the point where fifty per cent of the area is to the left and fifty per cent to the right, whereas *M* is located so that ninety-seven per cent of the area is to the left and three per cent to the right of it.

It will be seen from this that if these various points for the several paragraphs or selections can be located accurately in terms of some constant unit, the relative difficulty of the different paragraphs can be expressed in terms of the unit. Such a unit is to be found in the distance *CD*. If the two lines *XY* and *PQ* are drawn at such a distance from *MN* that they include one-half the area of the curve, then the distance *CD* is spoken of as the probable error (*PE*). This may be given a constant value. When this is done, the science of statistics has methods by which the location of the points *K*, *H*, and *M* can be determined in terms of this probable error. It is evident that a series of selections taken at random is not likely to have equal steps between them when this procedure is followed; and if the variations in the steps are too great, certain selections may have to be eliminated and others substituted.

Another point with respect to the standardizing of passages is that the same selection will have different scale values for the different school grades, and as a result the steps between these selections will vary from grade to grade. To get final values for the steps between the selections which he used, Gray employed the average step for each paragraph derived from the results procured from the various school grades. If such methods are used and the different selections in a test are so scaled, the differences in reading ability as found between different pupils or between different grades have a much more definite meaning than when the scale has not been so constructed.

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